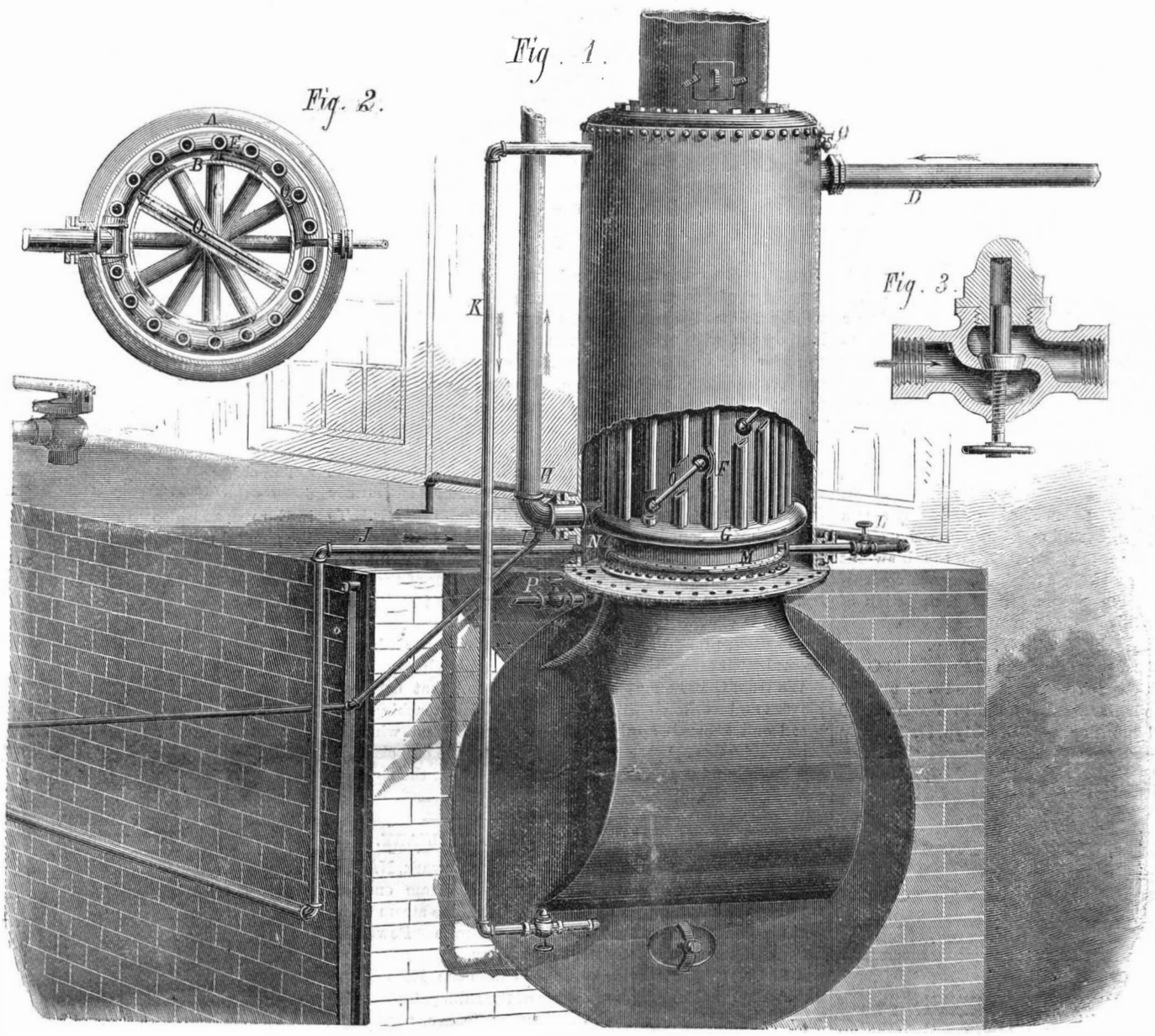
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXIX.—No. 10. [NEW SERIES.] NEW YORK, SEPTEMBER 6, 1873. [$3 per Annum. IN ADVANCE

IMPROVED FEED WATER HEATER AND PURIFIER.

It is a well known principle of physics that a liquid boils when the tension of its vapor is equal to the pressure it supports. Hence, as this pressure increases or diminishes, the tension of the vapor, and therefore the temperature of ebullition, must correspondingly vary. Under a pressure of 1 atmosphere, water boils at 212° Fah.; if the former be augmented to 2 atmospheres, ebullition is retarded, and occurs at 250·5°. Similarly, if we continue and increase the pressure to 50 atmospheres, the elastic force of the vapor will not be equal thereto until the liquid be raised to a temperature of 510·6°. It is evident, therefore, that to elevate the boiling point of water to a temperature corresponding to a given pressure of steam, the heat of the liquid at the outset is an important element in determining the quantity of fuel to be consumed in the operation. Thus, to illustrate, if a steam pressure of 5 atmospheres, or 75 lbs., to the square inch, be required, the boiling point of the water in the boiler must be at 320°; if the temperature of the feed be 212°, then there are 108 degrees to be supplied by the combustion of fuel; if 250°, 70 degrees, and so on. Every apparatus, therefore, having for its object the heating of the feed water of boilers, should, both in principle and practice, be doubly economical; first, through supplying the feed at the highest possible temperature; secondly, by effecting this result through the most thorough utilization of the heat generated by the fuel that is employed.



The device which we herewith illustrate is claimed to completely fulfil the requirements of the above propositions. Briefly described, it is a feed water heater and purifier, in which not only the heat of the exhaust steam, but that given off by the products of combustion in passing through the uptake, is utilized. Our engravings represent: Fig. 1, the application of the invention to a stationary boiler, and, Fig. 4, a somewhat different arrangement of the same principle in connection with a portable engine or locomotive.

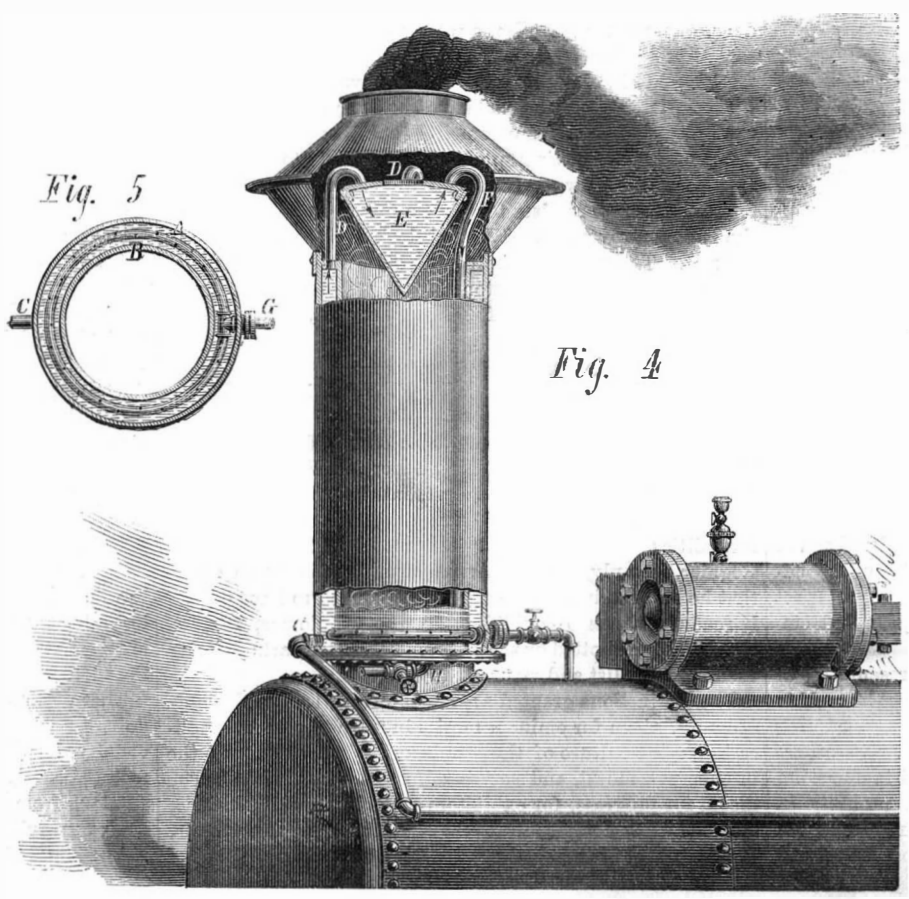
Two cylindrical shells, A and B (Fig. 2), are made of boiler iron, and, at their extremities, are provided with flanges, by means of which they are bolted together. When required, by removing the bolts the outer shell can be taken off, thus giving access to parts inside. In the inner shell, B, are perforations in which cross tubes, C, are expanded. These are arranged at different hights and in a spiral line, as indicated in the plan view, Fig. 2. The apparatus being placed at the end of the boiler and secured directly over the receptacle, the heated gases from the furnace necessarily pass up within the inner shell and around the cross tubes.

The exhaust steam from the engine enters through the large pipe, D, at a point about six inches from the top of the heater, and passes into the circular tube, E, Fig. 2. Thence it descends through the vertical pipes, F, into a second annular receptacle, G, from which it exits by the conduit, H. The steam does not circulate around tubes, E and G, because they have closed extremities at points respectively opposite those of inlet and outlet.

To the elbow of pipe, H, is connected a tube, I, through which the water due to condensation of the exhaust steam, as well as so much of the steam as is necessary, is conducted to the cistern in order to warm the water therein to such a degree as may not interfere with the operation of the pump. From the cistern the water passes to the heater by the pipe, J, entering as shown near the bottom of the apparatus and filling the tubes, C, and intermediate space between the shells, A and B. There, as is evident, it becomes heated by both exhaust and gases, and finally escapes into the boiler by the tube, K.

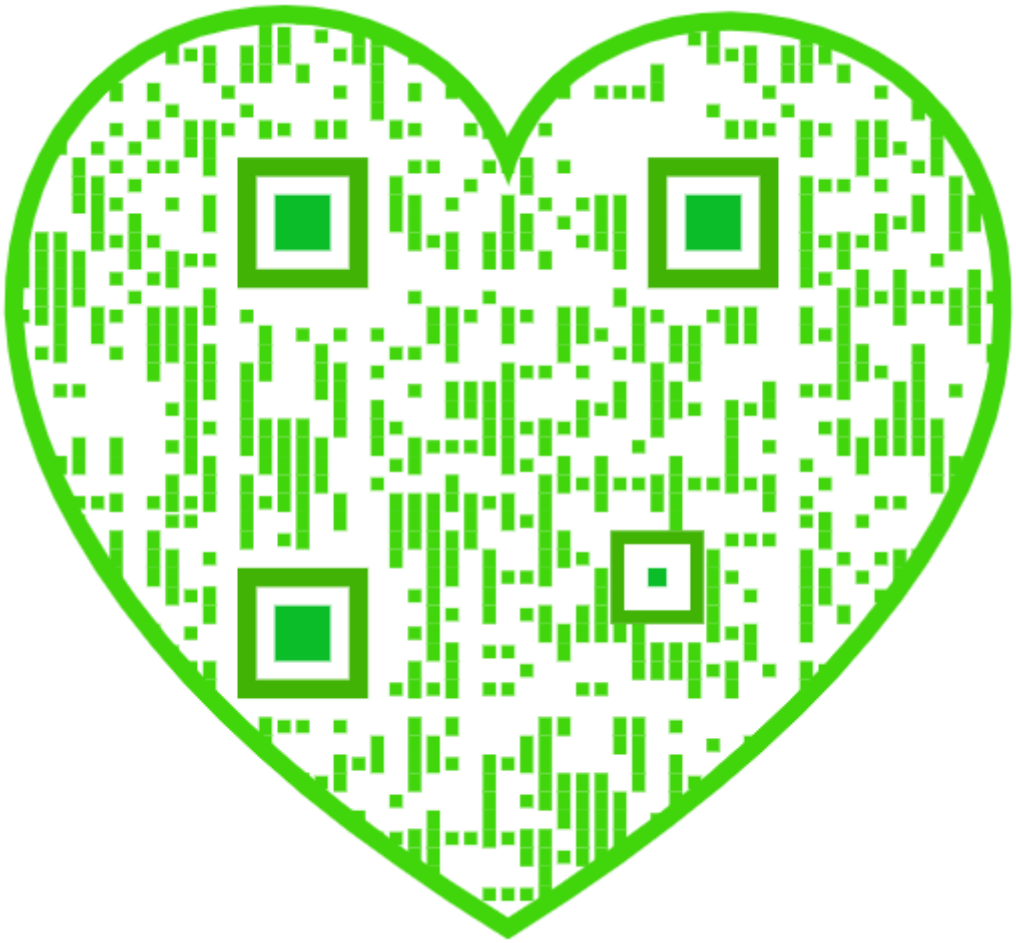
For cleaning the apparatus, a very ingenious and, it is claimed, efficient arrangement is provided. The heater is first filled with water, and then the valve on pipe, L, is opened. Steam directly from the boiler is thus conducted into a perforated circular tube, M, through the orifices of which it escapes, breaking up whatever sediment or mud may have accumulated at the bottom of the intermediate space; and thence it passes through a system of pipes beginning at N, and leading through all the tubes, C, as shown at O (Figs. 1 and 2). These pipes are closed at the further end of the system, and are also perforated, so the steam, emerging, acts upon the impurities packed on the inner surface of tubes, C. The blow-out cock, P, is then opened, through which the water in the heater escapes, and also the sediment driven out by the steam. In filling the apparatus the steam from pipe, L, is shut off and the cock, P, closed. The small jet cock, at Q, is then opened to allow the air to escape, and the valve at the bottom of pipe, K, raised. The construction of this valve is represented in section in Fig. 3. When the feed water emerges from the heater in the direction of the arrow, it lifts the valve from its seat, but, as is evident, is prevented from flowing back. On raising the valve, however, by the screw and hand wheel shown, the steam pressure within the boiler forces the water up through the pipe, K, and thence into the heater. When full, the valve is closed, and the air cock, Q, shut, and the cleaning process already described repeated if desired.

FRANCE'S FEED WATER HEATER AND PURIFIER.



The feed water, entering by the pipe, J, at the bottom, comes in immediate contact with the cooler portion of the contents of the heater, and does not reach the hot metal above until thoroughly mixed. The exhaust, on the other hand, entering at nearly the top, meets at once with the most heated part; for so long as there is fire under the boiler, the water in the apparatus can be kept warm independently of the steam from the engine. This is of especial advantage in firing up in the morning, for by the time the engine is ready to start, the contents of the heater will be sufficiently elevated in temperature to prevent the sudden expansion due to the hot exhaust being instantly turned upon the cold metal. Similarly in machines which lay by three or four times daily, in-

© 1873 SCIENTIFIC AMERICAN, INC



stead of cold feed being passed through to the boiler, as it might be, were the water dependent for its heat upon exhaust alone, the reverse is the case. Moreover, it is claimed that, from the relative points of entry of steam and water, a uniform temperature of the feed is kept up, which can be maintained through the regular working of the pump.

The inventor lays particular stress upon the point that this device furnishes water to the boiler at a hotter degree than can be attained through using exhaust steam singly. Thus, we stated already that the temperature of water or steam, due to a pressure of 75 lbs. to the square inch, is 320°. After this steam has passed through the engine it has probably a pressure of not more than 4 lbs. to the square inch, which corresponds to 225°, nearly. This communicates its heat to the feed; and were the latter dependent upon this source only, it is evident that the temperature thus reached would be the highest attainable. But, in addition, must be considered the effect of the hot escaping gases, which, if the boiler be properly set, pass through the inner shell at a heat equal to that within the flues or tubes, or of at least 325°, and act on the contents of the apparatus. Clearly, then, by such means the temperature of the feed is still further elevated, so that the claim of the inventor, that the present device is superior in this respect to a heater operated by exhaust alone, appears, supposing the latter to be otherwise equally efficient, to be well founded.

The cleaning process is facilitated, as well as a further economy of fuel effected, through the purification of the water, which, it is stated, takes place within. The feed, in passing out from above, expands as it nears the top, causing a separation and precipitation of sediment, so that the latter, instead of entering the boiler, drops to the bottom of the heater, and is thence removed by the means already described.

In Fig. 4, the same principle is followed in arranging a heater in combination with the smoke stack of a portable engine. A and B are the outer and inner shells, between which feed water is admitted from below by the pipe, C. Thence passing in the direction of the arrow, through two or more pipes, D, the water enters an inclosed conical pot, E, where it receives still further heat from the mingled escaping gases and exhaust. From pot, E, the feed is forced down the pipe, F, which may be either inside or outside of the smoke stack, and thence into the boiler. Cleansing is effected by steam admitted through the pipe, G, and escaping from the circular perforated tube shown in Fig. 2. H is the blow-out valve. The same claims, already explained, regarding freedom from sudden expansion of metal and precipitation of sediment, are made for this application of the device.

Patented August 6, 1872, by Mr. S. W. France. For further information, address Messrs. Heron & France, 40 Cortlandt street, New York city; or the apparatus itself may be seen in operation at the boiler works of Smith Brothers, 40 Jay street, corner of Plymouth street, Brooklyn, N. Y.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 ..... 25 00
Over ten copies, same rate, each 2 50

VOL. XXIX., No. 10. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, SEPTEMBER 6, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

American Association for the Advancement of Science 153
American inventions, foreign appreciation of 155
Answers to correspondents 153
Balloonaria 152
Balloonists, a suggestion for 149
Bisulphide of carbon auxiliary, the 144
Bridge, counterbalanced lifting* 151
Business and personal 155
Caloric engine valves* 149
Caoutchouc—where it comes from, etc. 145
Ear, injuries to the 152
Feed water heater and purifier* .. 143
Friction attachment* 150
Hot air engine, the 149
Hulling stone, the Ironclad* 150
Infection, the nature of 152
Journal box, a good* 152
Kansas City, Mo., and its coming exposition* 151
Lightning freak, a 153
Lightning rods—A few practical hints 149
Mechanic, the average migratory 144
Mennonites, the 152
Navigation in a fog, skillful 153
Nebular theory and Kepler's laws, the 154
New books and publications 154
Notes and queries 155
Optical instrument, new 152
Patent Congress at Vienna, the .. 144
Patent decisions, recent 154
Patents, official list of 156
Patents, recent American and foreign 154
Poor man's representative, the .. 144
Porpoise, the 153
Railway disasters, remarkable 153
Railway, the Indo-Russian 151
Sierra Madre tunnel, the 153
Steam pipes, ignition from 149
Telescope, the proposed great 149
Testing machine, improved* 152
Vienna, American sewing machine awards at 145
Vienna exposition palace, the architect and builder of the* .. 147
Vienna exposition, steam boilers at the 148
Vienna exposition, the award of prizes at 144
Vienna exposition, the—Letter from Professor Thurston 148
Vienna exposition, the machine room of the* 146, 147
Weather strip, window* 150
Wrench, improved* 150

THE POOR MAN'S REPRESENTATIVE.

We note with gratification the projected visit to this country of Mr. Joseph Arch, a man who may be considered as the embodiment of a principle, of which we have frequently advised the observance. We allude to moderation and a respect for mutual rights in conflicts between employers and employed.

Mr. Arch was an agricultural laborer, a representative of the peasant class of England. Unaided, he taught himself to read and write, and afterwards joined the Methodists, coupling his duties as a workman with those of a preacher to others of his sect. By thrift and energy, he succeeded in amassing sufficient funds to purchase a small freehold property in Harbury, Warwickshire; and having thus assured himself a substantial home and certain means of livelihood, he turned his whole mind to the advancement of the interests of the class to which he belonged.

Mr. Arch is not a demagogue, nor does he aim to maintain the rights of labor by extreme measures. Neither is he allied to any political creed or faction. He simply strives to secure, for a disorganized, scattered and down trodden class, a just return for its toil. To this end, he has traveled around England, diffusing information; in some cases leading men in direct opposition to employers, in others counseling cooperation or compromise, but in every event enforcing his views with such reason and moderation as to convince even the most ignorant that his work was for their advancement and benefit. The result is that at the present day he is the recognized leader of 100,000 men, organized in a powerful and growing movement.

The agricultural labor difficulties in England are perhaps the legitimate results of the surplus of population crowded within the narrow limits of that country. There are far more people seeking work than there are places to be filled, so that individual competition is necessarily so strong as seriously to retard efforts to improve the condition of the laboring classes through gaining better wages for them. Following out his precept of demonstrating to the workman the place where he can obtain the best return for his labor, Mr. Arch crosses the ocean in order to investigate the condition of agricultural affairs in the United States, with the view of ultimately counseling the emigration hither of large numbers of his countrymen. His errand, we believe, will not be a fruitless one. He will find a vast and fertile territory waiting only for the labor of the farmer to yield rich returns, and will learn that acres by the hundred may be had of the Government for the asking, under no recompense other than the tillage of the soil. The laborer, at home a mere serf, wholly reliant for a means of existence upon the wealthy land owner, will, under our laws and institutions, become almost at once a freeholder, drawing a certain support and sustenance from his own farm. The emigration of such men to our shores will be of advantage to both nations; to England, through the diminution of her overgrown population, and hence the bettering of the condition of the other workmen that remain at home; to the United States, for the valuable acquisition of several thousand strong armed, sturdy farmers in now unsettled and uncultivated districts. To Mr. Arch, the benefits to be derived will be fully pointed out, while every facility will be afforded him for a thorough examination of the immense agricultural resources of the country. Whether productive of direct result in immigration or not, his visit will be both timely and welcome, for just such sound, practical views and advanced ideas as he has promulgated across the ocean are sadly needed here.

We trust that he may speak publicly, and that both employers and workmen will listen to him. His teachings are broad and general, applying to every trade; and while he counsels justice and the rights of labor to the one class, he as earnestly advises moderation and respect for the rights of property to the other.

THE BISULPHIDE OF CARBON AUXILIARY.

The Peters Manufacturing Company, of Newark, N. J., at present derive their power from a pair of steam engines, working one on each end of a main shaft. The steam cylinders are 20 inches in diameter and 4 feet stroke. Power 200 horses. Consumption of coal, 4 tuns a day.

This Company has lately contracted with the Ellis Bisulphide Engine Company, for the use of the Ellis patents as follows: One of the cylinders is to be run by steam as at present; the exhaust therefrom is to be sent through the Ellis bisulphide of carbon boiler, and employed to convert the liquid into vapor, which is to be used in the remaining cylinder. Thus one cylinder will be operated by steam, and the other by the vapor of bisulphide of carbon, heated by the steam exhaust. Mr. Ellis, at his own expense, puts up and attaches the bisulphide of carbon apparatus, and runs the engines for 60 days, guaranteeing to effect a saving of 50 per cent of the coal at present consumed. If he accomplishes this, he is to receive $8,000 dollars in cash, and a royalty equal to one sixth of the value of the coal saved, so long as the company continues the use of his patents. If the bisulphide auxiliary fails to effect the saving specified, Mr. Ellis is to remove the apparatus at his own expense. This seems to be a good arrangement, and promises to afford a fair test of the value of the Ellis improvement. We shall look for the results with interest. The work is to be completed within sixty days.

The Atlantic Works, Boston, Mass., are now putting in the engines for a tugboat of 400 horse power, in which the Ellis bisulphide auxiliary is to be employed.

AWARD OF PRIZES AT THE VIENNA EXPOSITION.

The distribution of the premiums awarded at the Vienna Exposition took place on the 18th of August (the Emperor's birthday), in the Imperial Riding School, in Vienna. About three thousand persons were present, but the ceremony is characterized in the dispatches as a rather tame affair. The formalities consisted in a brief speech by the Arch Duke Regnier, in reply to which Arch Duke Charles Louis stated that he had received the Emperor's command to have publicly read the names of exhibitors to whom diplomas, medals, etc., had been allotted by the jurors. Baron Schwartz Senborn then read the list and returned thanks.

The distinctions granted are as follows: 1. The diploma of honor, given for eminent merits in science, and its application to the culture of the people and advancement of the intellectual, moral, and social welfare of mankind. 2. The medal for progress, for exhibitors who, by new inventions, etc., can show notable improvement over former expositions. 3. The medal for merit for perfection of work and general superiority of produce. 4. The art medal, for contemporaneous fine art produced since the London Exposition of 1862. 5. The medal for good taste, for those who distinguish themselves in articles in judging which, form and color are in the first line decisive. 6. The coöperative medal, for managers of factories, foremen, designers and other assistants who contribute to the excellence of products or extent of consumption. 7. Honorable mention, given to exhibitors who show merit, but not in a sufficient degree to warrant the bestowal of a higher award.

The medals are in bronze, 2¾ inches in diameter, bearing on the obverse a portrait of the Emperor of Austria with the inscription in German, "Francis Joseph I, Emperor of Austria, King of Bohemia, etc., Apostolic King of Hungary." The reverse side contains emblems and artistic designs according to the respective classes. The medal of merit has, in addition, another inscription, of which the following will serve as an example. "*Welt-Austellung*, 1873. *Wien. Fur Verdienste*," or "World's Fair, 1873. Vienna. For Merit."

The list of American awards, recently sent per cable and published in the daily journals, has so many inaccuracies and, in the matter of the names, is susceptible of so much doubt that we defer its publication until the reception of more complete and reliable information. It would seem, however, from the number and wide field covered by the premiums, that it would be rather singular if any exhibitor failed to receive some honor; and hence it may perhaps be safely inferred that none of our representatives will return empty handed, unless, of course, they have voluntarily withdrawn from competition.

THE PATENT CONGRESS AT VIENNA.

The delegates to this gathering, from the various States of the continent and from this country, assembled on the 4th of August, in the Jury Pavilion in the exhibition grounds at Vienna, and organized by the election of Baron Schwarz-Senborn as honorary president, and a council, of which C. William Siemens, of London, was chosen president, with several secretaries, of whom Mr. Black, of New York, is one.

The object of this Congress, it will be remembered, is to discuss the propriety of establishing a uniform patent law in Europe, and also to suggest, to the several governments, the general principles and features which such a law ought to embrace. According to *Galignani's Messenger*, the following resolutions have been adopted:

"1. Only the inventor himself or his legal successors shall obtain a patent. The granting of a patent cannot be refused to foreigners. 2. The donation of a patent for an invention to be for fifteen years or for a shorter term with the option of extending it to that period. 3. The complete publication of the patent to be obligatory. 4. The expense of granting a patent to be established on a moderate but progressive scale." The amendment proposed by the American delegates, to introduce a graduated tax upon patents according to the condition of each respective country, was withdrawn after repeated doubtful votes had been taken. "5. A specification of all patents in force must be accessible to the public."

The Congress is to continue the debate upon the sixth resolution, whereby it is made obligatory on the holders of patents to place their inventions at the disposal of everybody wishing to use them upon payment of a fitting remuneration.

The first five resolutions appear to be practicable enough, and are based upon existing laws, now in vogue in most of the continental States. The proposed sixth resolution is a novelty in patent legislation and in legal jurisprudence. It is a suggestion from some of the addled heads of Great Britain, we believe. It is intended, in that country, to involve the appointment of a commission of lords, dukes, or barons, who shall establish the price at which an inventor may sell his device after the grant of a patent. Such an enactment would be absurd as well as unjust to the inventor. If it is right and desirable for government to fix prices for the inventor, why not in like manner establish rates for authors, merchants and dealers in commodities of all sorts?

LIGHTNING RODS.---A FEW PRACTICAL HINTS.

To the Editor of the Scientific American:

On Saturday the 26th of July last, at about a quarter to one, A. M., in the village of St. Michel, some 15 miles below Quebec, where I have my country residence, the lightning fell during a thunderstorm on the house of one Boulanger, with the following effects, which I believe are worthy of note:

The house is a two story one with a hip roof of ordinary pitch. The electric fluid struck the vertex of the triedral angle formed by the plane of the hip and those of the front and rear slopes of the roof. It there divided into three distinct and separate parts, one of which went northward or towards the rear of the house, following the line of rafter, along which it traveled, and tearing up the shingles as it passed along. From the foot of the rafter, it jumped to the top of a window situated immediately below it, and followed the center of the window along the iron bolts or fastenings, tearing away strips of the woodwork several feet in length, and projecting them to considerable distances within the house. From the bottom of the upper window, the lightning leaped to the top of the window below and, following the bolts as before, with the same effects, passed into the earth or foundation.

That portion of the electric fluid which went westward down the hip did not follow a rafter, there being none in its vicinity, but followed the tongued and grooved joint of the roofing boards, and, as in the other case, tore up the shingles all along from the apex to the eaves, passing down as before along the mullion or center of two windows situated in the end of the building, one below the other, again following

© 1873 SCIENTIFIC AMERICAN, INC

the window bolts and tearing away long strips of the wood work, one of which, four feet long, was projected through an interior door to a distance of fully 30 feet.

The third branch or portion of the divided fluid went southward along the rafter (but in this case without tearing up the shingles) from the foot of which it jumped to the window bolts of the uppermost of the front windows; and, as the window below is a shop window, with no mullion or bolts, the lightning jumped from the bolt of the upper window to the hinge of the blinds, and thence passed down between the frame and architrave of said lower window, which architrave was torn away and projected a distance of 40 feet to the opposite side of the roadway.

The man, Boulanger, who had risen during the storm, stood, at the moment the thunder fell, about midway between the fore, aft and end windows above mentioned, or very nearly under the apex of the roof or point where the lightning struck. He was knocked senseless and fell in the doorway where he stood, but soon recovered and is just as well as ever, while his wife and children, who were near him at the time, were unaffected by the shock. A sulphurous odor pervaded the house, so says the man.

Now, Mr. Editor, has it ever happened before that the electric fluid has thus divided into two or more separate branches, and if so, would it not be advantageous that lightning rods or conductors be bifurcated or trifurcated at the base, the separate branches thereof passing down from the apex of each of the hips of isolated buildings, or down the front and rear roof slopes of buildings in cities, to the ground, by two or more outlets?

One query, Mr. Editor: What is it that projects the large splinters of woodwork to such distances, as in the present case? The ignition and explosion, I suppose, of the gases within the pores of the wood; but how explain the projection of the architrave of the lower front window to some 40 feet, where the frame itself was not in any way splintered or destroyed, and where the electric fluid appears to have merely passed down between the architrave and the lower frame of the window? Is the action merely mechanical or is it chemical, that is, can the fluid in its passage, and by its immense velocity, so condense the air itself, or the oxygen it contains, as to cause an explosion capable of accomplishing the phenomenon alluded to? C. BAILLAIRGE.

REMARKS BY THE EDITOR.—It would be hard to find a more beautiful illustration of the principles laid down in the paper on "Lightning Rods," published in our issue of August 16 (page 96 of our current volume), than that furnished in the above communication.

It appears that this house, with its Mansard roof: with more or less of metal on its exposed angles and edges, and its window bolts standing vertically, no doubt: offered three tracks of nearly equal resistance to the electric discharge.

The one, however, over the shop window, which had no bolt, being the worst track of the three, carried the least quantity of the discharge, and thus the shingles in this line were not disturbed.

The mechanical effects of lightning are usually purely physical and due to the expansion of air by the heat, or the development of steam from moisture, where that is present. The present writer has in his possession an induction coil giving sparks of 21 inches in air, with which many of the actions of lightning may be imitated on a small scale. Thus if the spark is taken across the surface of a piece of pine wood, slightly moist within but well dried on the surface, fine splinters or fibers will be torn off at each flash and projected to the distance of several inches. These are torn out by the explosive force of the heated air and steam, developed by the passage of the spark between the fibers near the surface.

Lightning flashes breaking into numerous forks or "derived circuits" are by no means uncommon, although much less usual than the single "streaks." We have repeatedly seen them, and the phenomenon may also be beautifully imitated by taking the flash of the coil above mentioned across a crumpled sheet of metallic paper, such as is often used in packing coffee or spices. The tracks will here be five or six feet long and sometimes single, double, triple, or indefinitely multiple. Multiple lightning conductors are useful because each one helps the others, and if the discharge is too great for one, they will be able to carry it between them, but what is more important is this: The less the total resistance of the conductor to earth, the more certain is it that no other, undesirable line will offer an approximately good path to the earth, and so get a part of the flash. Thus, suppose a single rod whose resistance is 1, and that a series of bolts, hings, gutters, stove pipes, etc., offers another line (passing perhaps through the walls of the house or the body of its occupant) whose resistance is 2. Now, under these conditions, a flash would be likely to divide itself, and while $\frac{2}{3}$ would go safely down the rod, $\frac{1}{3}$ passing along the other line might burn the house or kill the man. But if two rods were connected, the resistance in this line would be but half, hence $\frac{4}{5}$ would take this road and but $\frac{1}{5}$ tend to go by the other. Again, the less the resistance of any line, the higher the opposite charge developed in it by induction, and hence the greater its attractive influence, leading the discharge to prefer it as a path. This bears upon the importance of connecting all accidental lines of conductors, such as gas and water pipes, with the lightning rods. Insulated, these are opposition lines, soliciting the lightning to come into the house and traverse them; connected, they help the rod as we have seen, to get and keep the lightning outside.

THE price of quicksilver on the Pacific coast has risen to $1.10 per pound.

CAOUTCHOUC---WHERE IT COMES FROM, AND HOW IT IS PREPARED.

The extensive and rapidly increasing employment of caoutchouc in the arts has, within the past few years, raised this uniquely useful substance from its humble estate as a mere rubber-out of pencil marks to the front rank among vegetable products. Thousands of tuns are already required to meet the annual consumption, and almost every part of the tropical world has been laid under tribute to supply the demand.

The plants which yield caoutchouc are restricted to three natural orders, namely: 1. *Euphorbiaceæ*, represented by several species of lofty trees (*hævea or siphonia*) inhabiting the hot and humid valleys of the Amazon, and the Rio Grande do Norte. 2. *Artocarpaceæ*, comprising several varieties of Ulé trees (*castilloa elastica*, etc.) ranging from the Gulf of Mexico to Guayaquil; a number of species of fig trees (*ficus elastica*, etc.) occurring in North Eastern Hindostan, Farther India, Java and Northern Australia. 3. *Apocynaceæ*, represented by *hancornia*, in Southern Brazil; *landolphia*, in Equatorial Africa; *vahea*, in Madagascar, and *urceola* in Malacca and Borneo, all except the first named being climbing vines and shrubs.

The finest quality of caoutchouc is the Pará, the trade name of the Brazilian products from that port.

The collection of Pará caoutchouc begins in August and continues until January or February; in the wet season the milk or sap is too watery for profitable working. When it flows from the trees, the milk has the consistency and color of cream, but it soon curdles by the separation of the caoutchouc from the whey-like liquid in which it is suspended. The trees are usually tapped in the evening, and the milk collected in the morning.

The native method of preparing the caoutchouc for market is to evaporate the milk over molds of wood or clay, by means of artificial heat tempered by the smoke of roasting nuts. The milk is poured over the mold and hardened in successive layers; then, when a sufficient thickness has been obtained, the mass is cut through on one side and the mold removed, leaving a pouch, the parent of the original rubber shoe. By European manufacturers, the milk is coagulated by the use of alum water or ammonia, and the caoutchouc hardened by pressure; a better way, in that it allows the manufacturing to be done away from the scene of collection, which is always unhealthy.

The export from Pará is now about 5,000 tuns a year, half of which comes to this city. It appears in market in several forms: "biscuits" or flat pouches, made by dipping and smoking with round molds; "bottles," made in the same manner over molds of corresponding shape; "nigger heads" or solid balls, sometimes a foot in diameter, made by rolling small pieces together; and lastly, as loose scrap.

Pará caoutchouc, being stronger, purer and more enduring than any other, is indispensable for articles requiring great strength and elasticity, such as springs for railway cars and the like.

An article of similar quality, but less pure, is that known commercially as Ceará scrap. It comes in the form of balls or blocks, made up of reddish brown string, like pieces rolled together. Like the Pará, it is the product of *hevea*. The same trees also abound in French Guiana, Venezuela and Eastern Peru, in the dense moist forests along the river valleys.

The second in rank among the producers of caoutchouc is the Ulé tree, which abounds throughout Central America and Western South America as far south as Peru. Two, perhaps three, species are tapped. They thrive best in thick, damp, warm forests, growing to perfection in the basins of Lakes Nicaragua and Managua. The milk flows at all seasons, but is best in April. A tree eighteen inches in diameter, skillfully tapped, will yield about 20 gallons of milk, giving 50 pounds of caoutchouc. The milk is usually coagulated by the addition of the juice of certain plants, the caoutchouc separating as a soft brown mass, smelling like new cheese. It is then taken out of the brown liquid in which it was suspended, and pressed into cakes weighing about two pounds each.

Sometimes the caoutchouc is allowed to separate spontaneously, which occurs after the milk has stood half a day or so, and is then left to dry for a fortnight before pressing. At other times the milk is simply poured upon prepared ground, when the watery part is absorbed or evaporated. It is sent to market in cakes called *tortillas* or *meros*, in balls or *cabezza*, and in *bolas* formed by the natural drying of the milk in the cuts made in the tree. The last variety is especially prized.

Six or eight hundred gatherers are employed in the San Juan district (Nicaragua), and as many as two thousand in the neighborhood of Panama, where the trees are cut down to obtain the caoutchouc. The New Granada product, known to the trade as Carthagenia, comes in sheets three fourths of an inch in thickness, and is of good quality, though sometimes tarry from admixture with gum from the wood, the result of unskillful tapping. Guayaquil caoutchouc is very irregular in quality. The best kinds are of a whitish color, and come in large flakes or lumps. The poorer varieties are spongy, and saturated with a disagreeable black liquid, which stains the hands and sickens the workmen who use it. The best of the Central America brands is that known as West India, though not a product of the islands. The finest quality comes in blocks made up of thin sheets, and is of great purity. Guatamala caoutchouc is the poorest. It is prepared like the West India, but is spoiled by tarry matter.

The remaining caoutchouc region of America comprises the high plateau of Southern Brazil, between 18° and 12° south latitude. It affords a good quality known as Pernambuco, obtained from several varieties of *hancornia*. These trees grow to the size of the apple tree, with small leaves and drooping branches, which give them the appearance of the weeping birch. The milk is not much collected, the trees being more valued for their fruit, which is held in high estimation.

The principal caoutchouc tree of Asia is the *ficus elastica*, which flourishes chiefly in Assam, Farther India, Java, Sumatra and Australia, north of the isotherm of 70° Fahr. In many parts of the Assam district, the trees have been destroyed by reckless tapping, and a still more reckless felling of them to render the operation of tapping more convenient. When properly bled in the month of August, an average tree yields about 15 ounces of pure caoutchouc. During the cold season, from October to March, the milk is scantier but richer than during the warmer months. That which flows from the branches is allowed to dry on the tree; that from the trunk and roots is collected in holes in the ground and in large leaves rolled funnel-wise and prepared artificially. The milk is either poured into the boiling water and stirred until it is stiff enough to be handled, or it is mixed with water in a tank and allowed to stand until the caoutchouc separates and floats like cream on the surface. It is then boiled over a slow fire until it coagulates, when it is taken out and pressed, after which it is boiled again, pressed, dried in the sun and washed with lime. It is sent to market in baskets of split rattan, holding about three hundred weight. Assam caoutchouc has a peculiar mottled appearance, the color ranging from cream color to a bright pink. It is seldom pure, the admixture of bark and earthy matter amounting sometimes to a third of its weight.

Singapore caoutchouc, the product of surrounding countries—Java, Sumatra, China, Manilla, the Malay peninsula, and Penang—is chiefly from the *ficus elastica*. Some bearing the same name comes from Borneo, Sumatra, and Malacca, and is the produce of the vine *urceola elastica*, a climbing plant of rapid growth and great size, often attaining a length of two hundred paces and the thickness of a man's body. The vine is usually cut into small pieces for the convenient extraction of the milk, the flow being hastened at times by applying heat to one end of the sticks or billets. The caoutchouc is separated by the action of salt, which causes the particles to coalesce. When fresh, the Borneo caoutchouc is white, soft and spongy, the pores are generally filled with salt water and whey. When dry and old, the color changes to a dull pink or red. The quality is inferior.

The caoutchouc of Madagascar, also obtained from a vine, is of excellent quality. It is prepared by treatment of salt water, and also by artificial heat. It is largely used in France, and ranks next to the Pará in price.

Equatorial Africa is rich in caoutchouc-yielding vines and trees, but its resources are but slightly developed. The collection and preparation is conducted in the most slovenly manner, the caoutchouc being largely mixed with gum from the wood, which spoils the product.

African caoutchouc is received in the form of flakes, round balls and tongues. It is sticky, has a bad odor and but little elasticity. The chief districts whence it is exported are the Gaboon, Congo, Angola, Benguela and Zambesi.

Notwithstanding the wide range of caoutchouc-producing plants, the future supply of this indispensable product is becoming a matter of deep concern. Owing to the reckless habits of the native collectors, all the accessible trees are being destroyed with frightful rapidity, large districts being already stripped of them, and no pains taken to secure their renewal. Millions of trees remain, it is true, buried in almost impassable forests, away from means of transportation; but the cost of reaching them must ever prevent their being the source of much profit.

AMERICAN SEWING MACHINE AWARDS AT VIENNA.

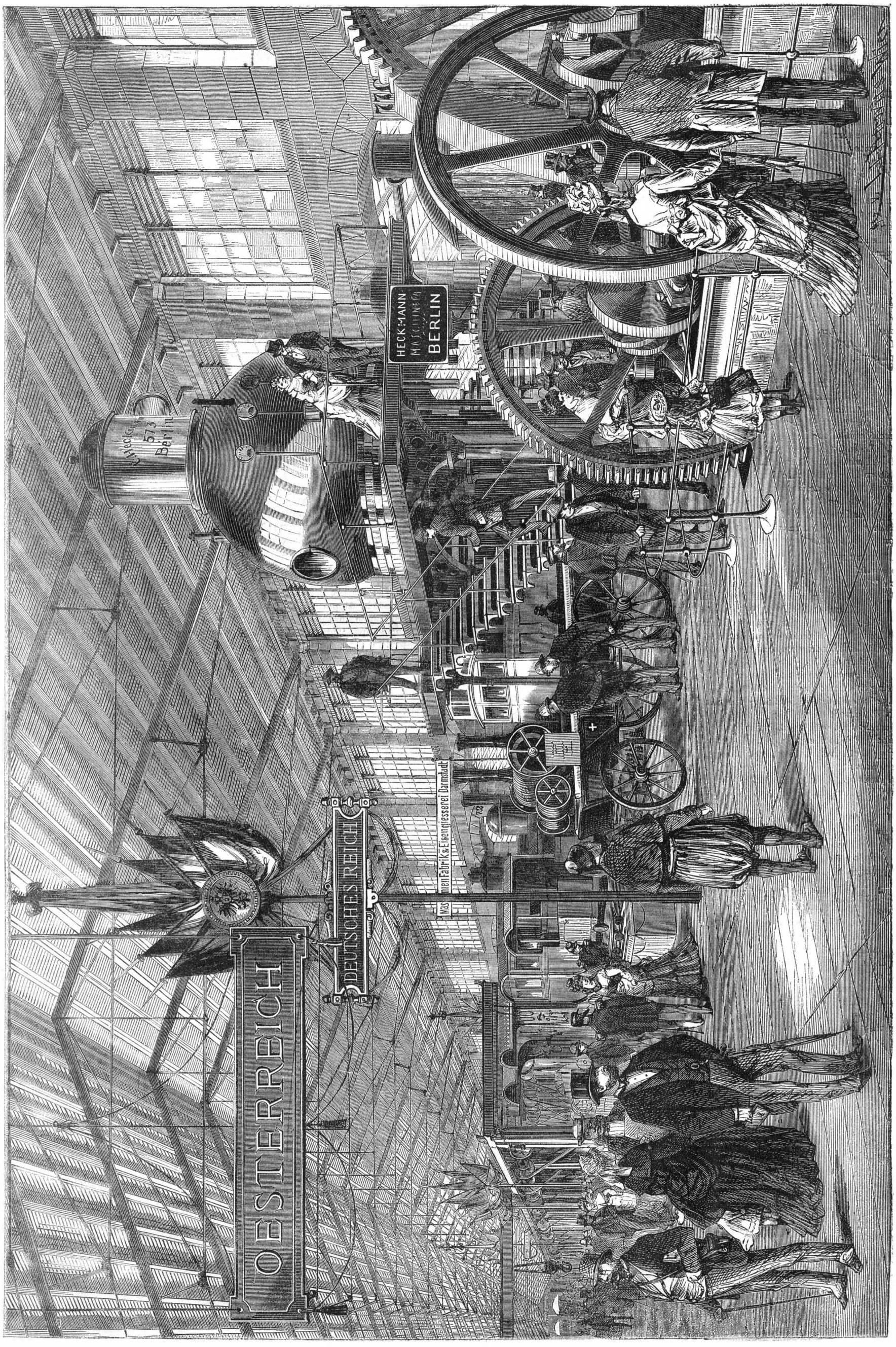
The official announcement of the prizes awarded for American sewing machines at the Vienna show, sent by telegraph, is so vague in detail and the statements of exhibitors are so conflicting that, at the time of going to press, we are unable to determine which machine has gained the highest honor. Nearly every one of the manufacturers competing advertises the fact of his having received "a grand medal," and undoubtedly with truth; but it should be remembered that the medals are not the greatest distinctions, and that the diploma of honor is the award which, as we understand the premium system, only one, and that the best, machine can receive.

There is probably no question but that the medals for merit and progress have been bestowed upon all our inventions of this class, either on the ground of utility, superior workmanship, or adaptability to special employments. Every report relating to the show indicates that our sewing machines have excited universal admiration, and have won the highest praises both from crowned heads and people. They have stood preëminent over the similar display of any other nation, and have gained for our general exhibit a degree of credit which otherwise it must have failed to receive.

The honor belongs to the energy, genius, and enterprise of our sewing machine manufacturers, whatever may have been their motive for exhibiting, and to them are justly due the thanks of the mechanics of the country whose skill has been so well represented by their handiwork.

The French Association for the Advancement of Science opened its session at Lyons, on the 21st of August. The city voted $4,000 to meet the expenses of the society, and placed the Town Hall and Saint Pierre Palace at its disposal. This is the second meeting of the Association, which now numbers 1,000 members.

© 1873 SCIENTIFIC AMERICAN, INC



THE WORLD'S FAIR AT VIENNA—VIEW IN THE GREAT MACHINE HALL.

© 1873 SCIENTIFIC AMERICAN, INC

THE ARCHITECT AND THE BUILDER OF THE VIENNA EXPOSITION PALACE.

The two portraits given herewith represent, respectively, John Scott Russell, the celebrated English engineer, and John Kaspar Harkort, one of the largest Vienna iron masters, two men to whom Austria is indebted for the design and construction of the magnificent edifice which forms, at her capital, the receptacle for the exhibited products of the world.

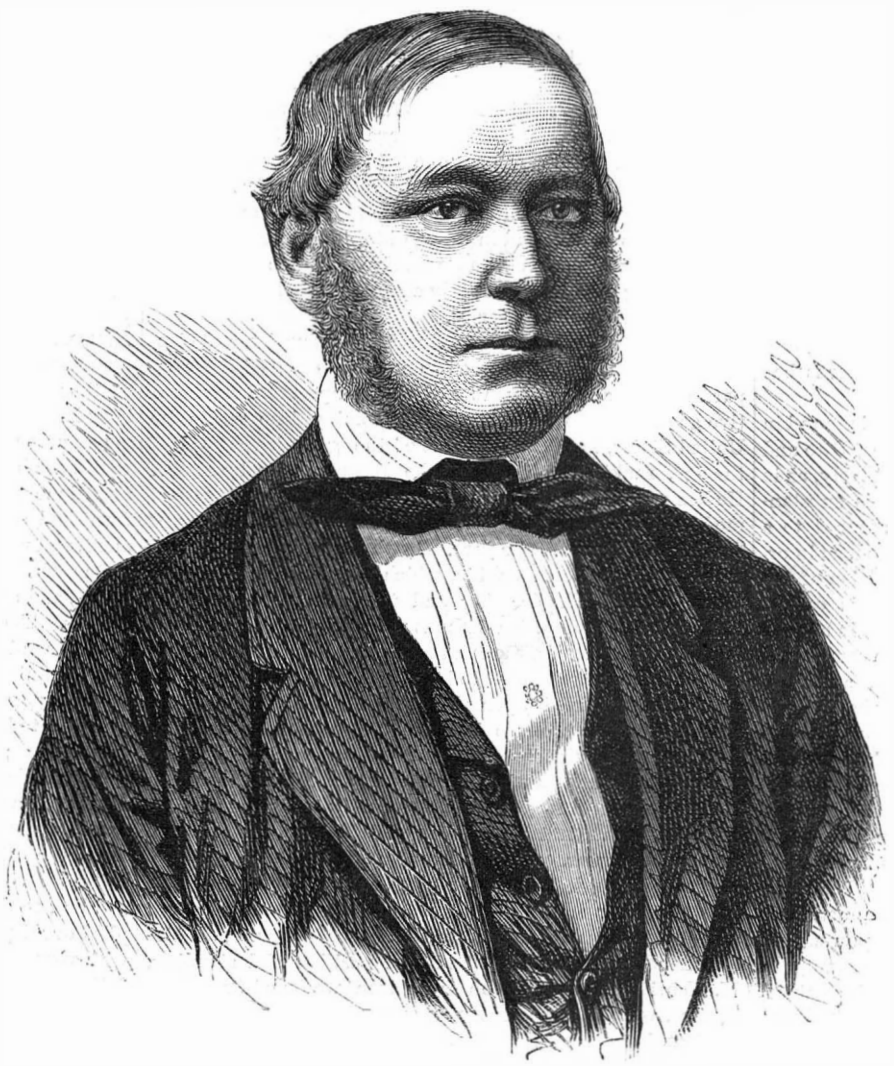
Mr. Scott Russell is perhaps best known among engineers as the author of the "wave line theory of naval architecture," by which the bows of vessels are made hollow and wedge-shaped, conformably to the wave of motion in water, while, in length, they are proportioned to the ship's run as 3 to 2. He was not the inventor of hollow bows, as asserted by some, but he discovered and applied to shipbuilding the principles of Nature.

In 1855, at his works at Millwall, London, Mr. Scott Russell began the construction of the celebrated Great Eastern, a work confided to him by her engineer, Mr. Brunel. The ship was necessarily experimental, and hence no small difficulties were encountered even before she was launched. The hull was completed in 1857, but, through some defects, required a year's additional labor and the expenditure of some $400,000 before she could be got into the water. Of the eight engines supplying the motive power, Mr. Russell built the four designed to operate the paddle wheels, and also supplied other machinery, the failure of some portions of which afterwards formed the ground of controversy with the owners, and elicited adverse comment from the press. The model of the Great Eastern, however, is exceedingly beautiful, and she is built on the wave line principle above described. To her fine lines and harmonious proportions her subsequent success, as a seagoing vessel, is doubtless due.

JOHN SCOTT RUSSELL.

The subject of our sketch was called upon, through the agency of Baron Schwartz-Senborn, to undertake the important task of designing the building for the Vienna exposition. Mr. Russell's first idea was to construct a dome 800 feet in diameter, but it was impossible to find either room or money for so gigantic a structure; it was eventually arranged that he should prepare designs for a building which should not exceed the width of 400 feet. Only a fortnight's time was given him to complete drawings and estimates; and in this short interval, an outline plan and section of iron work, together with the principal details and specifications, were finished under his direction. With these hastily prepared designs, Mr. Russell started for Vienna, but was met with opposition, both secret and public; while many endeavored to show the impossibility of carrying out such a gigantic cupola-shaped edifice. Aided by the energy of Baron Senborn, Mr. Russell was triumphant, and returned to England with the opinion of the mechanical committee "that Mr. Scott Russell's idea was ingenious, excessively simple, and, moreover, well suited to show how iron could be employed in a new and hitherto untried manner." The successful completion of the work has proved the exactitude of the purely theoretical calculations upon which the plan was based. As in the case with his former colossal labor, the Great Eastern, Mr. Russell relied upon the accuracy of his designs and the soundness of his principles to overcome unforeseen and incomputable difficulties, which might arise in the course of a construction hitherto unparalleled and unattempted. The raising of the immense iron ring, of enormous weight and over 100 feet in diameter, to a hight of 80 feet, and the placing of the girders, joining in a second elevated ring, was an astonishing feat, and, in a technical point of view, a new and important event in the history of mechanical science.

The first plans for the construction of the great edifice involved the use of large quantities of timber, for the supply of which proposals were invited by the exposition committee. The Austrians, however, even at that early date, began the system of extortion which they have carried through the entire enterprise, and arranged a "corner" in wood, endeavoring by such means to force the Government to pay a most exorbitant price for the large amount required. The "ring" operating the transaction were brought to sudden grief by the prompt alteration of the plans, and substitution of iron for the lighter material Tenders were then asked, not only from Austrian firms, but from many of the prominent iron makers in other countries. The Fairbairn Engineering Company, the Cockerill Company, of Belgium, and several other extensive French and English forges competed, but all were underbid by Harkort, who agreed to furnish the 4,000 tuns of iron work required from his foundery at Duisbourg, on the Rhine, in Westphalia. Being educated from youth up, by his father, for an ironware manufacturer, he devoted himself, when a young man, to the business, after finishing branch studies at Dortmund and Leipsic. The manufactory, which produced tools and scythes, became, under his guidance, so enlarged as to supply iron for railroads, and finally the work turned towards the building of bridges. The first bridge was at Coblenz, then followed the bridges over the Yssel, near Zütphen, in Holland, the Rhine bridge at Düsseldorf, the Elbe bridge at Hamburgh, Steudal, Meissen, the Danube bridge in Vienna, the Danube canal bridge, etc. The whole establishment is capable of sending out every year ten thousand tuns of building iron. The rotunda of the Exposition is the greatest work heretofore undertaken by Herr Harkort, and has added celebrity to his name and his establishment.



JOHN KASPAR HARKORT

Regarding the completion of the great structure and its details, we have already given full particulars. We add the two portraits as a part of its written history, for, by the genius and enterprise of the men represented, Vienna has been enriched with a building which, since it is destined to remain, will ever be regarded as a grand and wonderful achievement of modern engineering.

THE MACHINE ROOM OF THE GREAT EXPOSITION.

The large engraving upon the opposite page, for which we are indebted to the *Illustrirte Zeitung*, of Leipsic, represents a view in the machinery department of the Great Exposition. This building, it will be remembered, is 2,520 feet, or half a mile, long, and the clatter of the numberless mechanisms, when all are in motion, is something astonishing. Arranged along in the central part of this great hall are the various stalls or compartments in which the smaller or lighter machines are run, steam power being conveyed to them from the main shaft by means of belts, as shown. Among these machines are those for weaving and spinning, also pin and needle machines.

The large machine seen at the extreme right of our picture is a double steam engine of a hundred horse power, made by Sigl, of Berlin. It is a beautiful specimen of workmanship. A splendid dial indicator, which shows the number of strokes and revolutions of the engine, is one of the notable attractions of this machine. Next beyond the Sigl engine stands the great sugar refinery apparatus made by Heckmann, of Berlin. It is a resplendent object, shining like a mirror, being made of polished copper and brass. Access to this apparatus is had by means of iron stairways, which lead up to a platform that surrounds the machine. Here the stopcocks and siphons are arranged. From this platform, a very interesting and extensive view of the machine department is obtained, which the *Zeitung* characterizes as the submissive kingdom of Vulcan. Beyond the sugar refining apparatus, we have German fire engines, turbines, hydraulic apparatus, paper machinery. Then comes a great array of locomotives, cars, and railroad appliances.

The sign *Oesterreich* at the left, signifies Austria; that under the banners, *Deutsches Reich*, signifies German Empire.

The Octopus or Devil Fish.

For further elucidation of the habits and character of this marine monster, described by us on page 131 of our current volume, we extract the following from the pages of *Land and Water*, to which it was furnished by Mr. Henry Lee, of the Brighton aquarium, England:

"A crab was so fastened that the string could be withdrawn, and was lowered near to the great male octopus. He was sleepy, and required a great deal of tempting, but the sight of his favorite food overcame his laziness, and he lunged out an arm to seize the precious morsel. It was withdrawn from his reach; and so, at last, he turned out of bed, rushed at it, and got it under him against the plate glass, just as I desired. In a second the crab was completely pinioned. Not a struggle was visible or possible: each leg, each claw, was grasped all over by suckers—enfolded in them—stretched out to its full extent by them. The back of the carapace was covered all over with the tenacious vacuum disks, while the black tip of the hard, horny beak was seen for a single instant protruding from the circular orifice in the center of the radiation of the arms, and, next had crunched through the shell, and was buried deep in the flesh of the miserable victim.

The action of an octopus when seizing its prey for its necessary food is very like that of a cat pouncing on a mouse, and holding it down beneath its paws. The movement is as sudden, the scuffle as brief, and the escape of the prisoner even less probable. The fate of the crab is not really more terrible than that of the mouse, or of a minnow swallowed by a perch; but there is a repulsiveness about the form, color, and attitudes of the octopus which invests it with a kind of tragic horror.

© 1873 SCIENTIFIC AMERICAN, INC

THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 8.

VIENNA, July, 1873.

Beside the steam engines exhibited in the Machinery and Agricultural Halls of the exhibition, there are a few other "prime movers."

GAS ENGINES.

The Lenoir gas engine is exhibited in the French section, where it drives one of Gramme's magneto-electric machines, the recent invention of which has awakened so much interest among electricians. The Lenoir engine has now been in use many years, and evidently finds many purchasers. It is an engine in which the gas is first introduced into the cylinder, where it meets, and mingles with, the required amount of air, and, when the proper quantity has entered, the mixture is fired, impelling the piston by its expansion, which follows the explosion. As the piston must move a considerable distance before the full charge has entered the cylinder, that portion of the stroke is made without doing work. The explosion of the gas also gives rise, momentarily, to an extremely high pressure, which rapidly diminishes as the piston moves forward, and as the products of explosion, steam, carbonic acid, and nitrogen, condense and cool down. It follows, therefore, that the mean pressure obtained in the working cylinder is comparatively low, while the working parts of the machine must be built to withstand safely an extremely high pressure. The losses of pressure from condensation of steam and from the cooling of the gaseous products of combustion probably become much smaller at high than at low piston speeds, but are undoubtedly serious at all ordinary velocities.

There are many places, however, in which the gas engine is to be preferred to its more economical but less suitable competitor, the steam engine; and with the general introduction of illuminating gas in all cities, it has found quite a large market.

The consumption of gas given by these exhibitors for the best performance of their engines, I have been unable to learn, but early experiments made by that well known authority M. Tresca, of the *Conservatoire des Arts et Métiers*,—who is here, by the way, as a member of the International Jury, Group XIII—indicated the consumption, in small machines, of over ninety cubic feet per horse power per hour. Later experiments upon the Hugon gas engine, and with larger sizes, have given something over seventy cubic feet per hour and per horse power. No Hugon engines are exhibited here. The principal difference between the two lies in the manner of igniting the charge, the one using the electric spark obtained from a small battery and the *inductorium* or Rhumkorff induction coil, while the other uses a gas jet, ingeniously fitted to a little slide, which carries it into the cylinder to ignite the charge at the proper moment, and brings it out again to be relighted at a fixed jet after it has been extinguished by the explosion.

The only competitor of the Lenoir engine here is found in the German section. This is the gas engine of Otto and Langen. In this engine, the gas is fired explosively, as in the Lenoir, and the contrivance for igniting it is substantially that of Hugon; but the piston is not secured to a crank through the intervention of a connecting rod, as in ordinary engines, but rises freely under the impulsion of the exploding gases, and, when at its greatest hight, is caught and, falling slowly, its weight turns the shaft. It has the movement, in fact, of the Cornish engine,—the same rapid rise and the same slow descent of its piston, and is, of course, single acting. An engineer would hardly be likely to propose the application of the Cornish engine to driving mills and ordinary machinery. Its inequality of movement, and its large bulk for comparatively small power, would be serious objections, even if the first were not fatal in all cases. Nevertheless, the builders of this gas engine exhibit an engine numbered one thousand, and claim to have manufactured considerably more than that number. Their success in introducing what seems so extremely impracticable, a method of obtaining, satisfactorily, a motive power from the combustion of gas, is probably due to the exceptional economy of gas consumption which they have attained. They claim to have obtained the dynamometrical horse power upon a consumption of but one cubic meter of gas—less than forty cubic feet, or about one half that reported for the older gas engines—per hour. On one occasion, the trial of one of the larger sizes of this engine is reported to have given even a better result, bringing the figure down to about thirty-six cubic feet.

The source of this economy must be found, principally, and possibly wholly, in the rapidity with which it makes its upward stroke. The gases have too little time to condense or to fall in temperature seriously. This economy is probably so marked an advantage as to secure the success of this engine, where competing with those previously invented, in spite of the objections noticed. The first impression produced upon the mind of an experienced engineer by its noisy and irregular movement, and by the odor of gas which surrounds it, is, probably, almost invariably quite unfavorable; but it is here doing its work well, apparently, and its economy seems well proven, not only by the certified tests, but by its success in the market.

It cannot be doubted, however, that there is still room for important improvements in this class of prime movers, and we may anticipate that they will be effected before the lapse of a great length of time.

The Brayton gas engine is entered upon the catalogue of the United States section, but it has not made its appearance yet. As the juries have now finished their work, this engine will probably not be examined by a body which has among its members several of the most distinguished engineers and mechanicians of Europe, or of the world. It is a great opportunity lost.

THE TILGHMAN SAND BLAST

is another American invention which has attracted the attention of all members of the International Jury, and which might, possibly, have secured even higher honor than that accorded it by the American Institute of New York in the presentation of the Grand Medal of Honor. It is not ready, however, two months after the opening of the *Welt-Ausstellung*, and those jurors who, of all men, are best capable of appreciating the device, and of giving substantial aid to the inventor, have been unable to witness its operation. It will be considered a remarkably fortunate circumstance if it should be found that the jury have felt themselves justified in making any award at all, when able only to inspect the exhibited samples of work done by the sand blast.

THE JURY OF GROUP XIII (MACHINERY)

has, among its members, some famous men. The President, Ritter von Eugerth, is an Austrian engineer whose knighthood was conferred for distinguished services in connection with railroad work among the neighboring mountains. The elder of the two Vice Presidents is the venerable and distinguished Professor Karmorsh of Hanover, a pioneer in the great work of introducing, and of rendering truly practical, technical schools of high character, and of systematizing the whole scheme of German technological instruction. His work and his writings have made his name known to every educated engineer throughout the world. Although seventy-two years of age, the noble old man works with the jury every day, examining every machine with an intelligent interest, and inspecting the more valuable improvements with an enthusiasm which is quite in contrast with the indifference which less well informed or less experienced members occasionally exhibit. The Professor often returns to his rooms, in the afternoon, with pockets filled with specimens of work done by the machines which have been examined during the day, or even with the shavings which have been thrown out by some tool distinguished by its good work. The regard and the respect which is evidently felt toward him by all his colleagues, without exception, proves that the good work of his lifetime is known and appreciated by all. The second Vice President is Mr. Anderson, well known as the engineer who has under his charge all the British Arsenal and other machinery, and one of the most experienced mechanical engineers living. His little work on "Strength of Materials" has made him known to many of our own mechanics, who have found in it—as did those student mechanics to whom it was given, in England (as a course of lectures)—something which was precisely adapted to their desires and to their mathematical capacity.

Mr. C. W. Siemens, the engineer, metallurgist, and electrician, who has accomplished so much in each of these departments, is another member of the group. His regenerative gas furnace, which is rapidly coming into use in the United States, is pronounced one of the great inventions of the age, ranking with that of the Bessemer steel process. He has a large and interesting collection of machines and models in the exhibition, which are placed "*ausser Concurs*" that he may serve on the jury. In the list of his exhibits is an odd kind of steam engine, which should have been mentioned before. The drawing and the machine are equally difficult of interpretation without the assistance of some one familiar with them, although the device is by no means intricate. The water seems to be driven upward in successive compartments fixed upon the face of a wheel, and by its simple weight to produce revolution. Mr. Siemens has been "decorated" by the sovereigns of Europe, and he has acquired a more substantial reward for his labors in such an income as seldom rewards an inventor. His highest reward, however, is the enviable reputation which he sustains as a practical engineer, and as a man of science.

Professor Reuleaux, the Director of the *Gewerbe-Academie*, or engineering school, of Berlin, a distinguished educator and author, as well as engineer, Professor Hermann, of Aix-La-Chapelle, a gentleman of similar position and standing, M. Henri Schneider, of the great iron works of Creusot in France, who has placed *hors concours* one of the most beautiful exhibits in the *Ausstellung*, M. Tresca, the learned and distinguished Director of the *Conservatoire des Arts et Métiers* of Paris, and whose papers and experimental work are so often found useful to the engineer, and numbers of other hardly less distinguished men, are assigned to this group. It is by such juries that the awards are made. They will probably make some mistakes, but, on the whole, their decisions will probably have much more weight with the world than those of juries in general at public industrial exhibitions.

Listening to the deliberations of a jury so constituted would undoubtedly be exceedingly interesting to the public, were they permitted to be present. A proposition, made by a member or by the President, in the German language is often met by a rejoinder in French, the discussion is continued by a third member in English, and others join in with a *patois* of one or another of the three languages, in which interest or excitement infuses strange accents of the native language of the speakers, who may be Russians, Swedes, Turks, Greeks, or Spaniards, or even Chinese or Japanese. The discussion also frequently brings out some of the great men present, in most interesting histories of invention or of inventors, or, frequently, in very abstruse discussions of general principles.

We spent an hour, yesterday, in examining the

MAGNETO ELECTRIC MACHINE

of M. Gramme, already mentioned. Many machines of this class have been devised, all of which produce an electric current by the motion of one or of many magnets before a coiled wire conductor, or by the reverse arrangement of moving coils and stationary magnets. The older machines were unsatisfactory in consequence of the cost and the inefficiency of the large or numerous permanent magnets required, or the expense and trouble involved in their operation. Later, it was discovered that the electricity thus obtained might be employed to excite larger electro-magnets, from which a powerful current could be obtained by the use of a peculiar form of revolving armature invented by Mr. Siemens. Still later, it was found that no permanent magnets were necessary, but that, the electro-magnets retaining a small quantity of magnetism at all times, the machine could be set in operation and brought up to full power by diverting a portion of its own current for the excitation of the magnet, while the remainder of the induced electricity was given a useful application. It is to this latter class of machines that this apparatus of M. Gramme belongs. Its distinguishing peculiarity seems to be that there are several Siemens armatures, instead of but one, all arranged on a single revolving shaft, and set like the revolving knives of an old fashioned hay cutter, or, as a better illustration, like the teeth of a very broad faced watchmaker's pinion, or a gear wheel of small diameter. They are quite closely set, but are thoroughly insulated from each other. The electro-magnets are arranged in a usual form and possess no noticeable peculiarity.

In this large machine, one horse power is said to develope a current equal to that of sixty Bunsen standard elements, and to be capable of heating thirteen meters (over forty feet) of iron wire one millimeter in diameter (·004 inch) to a bright red heat. It weighs six hundred kilogrammes (1320 lbs.) and costs about the same, for similar power of current, as the Ladd machine which was, some time ago, described in the SCIENTIFIC AMERICAN. Its great and exceedingly important advantage is that its armature revolves but two hundred and sixty times per minute, but a fraction of the speed of the Ladd or the Wilde, and can thus be worked indefinitely without trouble from heated bearings, and with less consumption of power.

R. H. T.

STEAM BOILERS AT THE GREAT EXPOSITION.—LETTER FROM THE ENGINEER OF THE UNITED STATES DEPARTMENT.

The following letter from Mr. Pickering, engineer of the United States Department at the Vienna Exposition, gives interesting information concerning the steam generators and of the American exhibit in particular. The Pitkin boiler, here alluded to, is horizontal, 54 inches in diameter, 16 feet long, with 59 tubes 3 inches in diameter and 15 feet long:

VIENNA, July 23, 1873.

Messrs. Pitkin Bros. & Co.,

GENTLEMEN:—I don't know what you think of me for not writing you long before this time, but if you knew how busy I have been, and the extra work that has devolved on me on account of our commission troubles and changes, you would see how impossible it has been for me to pay proper attention even to those who, like yourself, have so kindly furnished some of the principal apparatus for our department, and without which we should indeed be in a sad plight.

On arrival here, I found only the foundation for the boiler house, and so was in time to see personally to all the boiler setting. The work of boiler setting progressed very slowly, indeed, as did all the work connected with the Austrian General Commission. But with all our drawbacks and delays, we finally got the boiler set and fired up, not the last, as we expected to be, but some two or three days before the French Department; and when all ready for firing, came the boiler testing. Your boiler was subjected to the customary hydrostatic test, and it was declared by the officer in charge to be the only one of the entire collection at this exposition which stood the cold water test without leaking. And now the boiler has been in constant use nearly two and a half months, and has, to the surprise of every one (including myself), supplied our department with all the steam we need, and that with very easy firing and very poor coal. We are running daily four steam engines: one 30, two 8 and one 3 horse power: one 650 pounds steam hammer, one steam puddling machine engine of 5 horse power, three steam pumps, and live steam when wanted for the sand blast exhibit of Tilghman, of Philadelphia. The main steam pipe, furnished by the

© 1873 SCIENTIFIC AMERICAN, INC

Austrian General Commission, is of very thin iron, 6 inches in diameter and 150 feet long. From this pipe all the steam is supplied, except to one 8 horse power engine, which receives its steam through 48 feet of 1¼ inches pipe continued from the end of the 6 inch pipe, making total distance of this last engine from boiler 238 feet, as there are 40 feet of 3 inches pipe connecting boiler to the 6 inches main pipe. This steam piping is not covered, and consequently condenses much steam; so much, in fact, that it was necessary to place a steam trap about the middle of the length of this pipe, to relieve it of the water of condensation. The exhaust pipes of these engines and pumps are so far from the boiler that it was found impracticable to use the exhaust steam for heating the feed water; consequently we feed cold water. I am now, more than ever, impressed with the economy and safety of this style of boiler, and our present and previous commissions, as well as myself, desire to express our thanks for your liberality and promptness in furnishing, for use of the American Department of this Exposition, so good a boiler, and one which is so true a sample of a style of boiler now so much in use in the United States.

Very truly yours, T. R. PICKERING,
Engineer U. S. Department, Vienna Exposition.

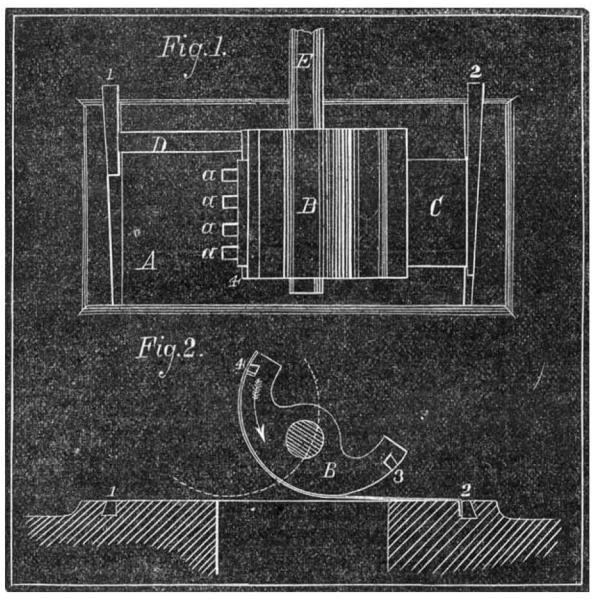
Correspondence.

Caloric Engine Valves.

To the Editor of the Scientific American:

Those engaged in improving the caloric engine may find the following design worthy of trial. If so, they will confer a favor by giving the results in the SCIENTIFIC AMERICAN.

The device consists of a plain rectangular valve seat, A, having several narrow ports, *a*, opening into one passage way, and key ways, 1 and 2, cut one across each end; a segment, B, operated by a shaft, E, extending outside the machine through a stuffing box (not shown); a sheet metal flap valve, C, fastened at one end to segment by a key, 4, the other to the valve seat by a key, 2, and a draw strap, D, put on just the reverse of C, fastened by keys, 1 and 3.



When the shaft rotates with the arrow, Fig. 2, the segment moves to the left, shutting the valve. When it rotates in a direction opposite to the arrow, it moves to the right, opening the valve. In both figures it is shown open. The dotted line, Fig. 2, indicates its position when shut. The shaft is placed near the outside of the segment to reduce its lateral motion to a minimum. The construction being understood, its operation will be apparent without further explanation. Probably the best material for C and D will be soft, thin, sheet steel, and the best results will probably be obtained at a comparatively high temperature, perhaps a dull red heat, steel then being very tough. In adapting this valve to an engine, accessibility should be studied; for, if accessible, a frequent renewal of C and D, when necessary, is inexpensive. F. H. R.

New Britain, Conn.

The Hot Air Engine.

To the Editor of the Scientific American:

The criticisms of your correspondent H. S. W. (on page 101 of your current volume), of my modifications of the air engine, are quite proper in view of the partial illustration upon which they were based.

If H. S. W. is a thorough practical machinist, I think that a little patient thought will reveal to him a happy expedient for each of the defects he has named. For instance, he fears that the machine will be top heavy. A machine with an eight inch crank need be but about six feet high to the shaft; then there certainly can be no form so simple and appropriate for a firm base for such an engine as that of a short cylinder with a massive flange at its base; the cylinder may be of any desired diameter and weight, the supply pump being placed centrally within this in the form of a lining; then four heavy standards or brackets, firmly fixed to the top of this base casting, will form an ample support for the hot air cylinder, in connection with the support afforded by the central supply pipe. As to the matter of getting at the pistons for repacking, the removal of the lower end of the connecting rods from the ends of cross arm (J) will let the pistons out at the bottom of the cylinders; and what can be more handy? The oilers would be so suspe nded as to be instantly movable to one side.

As to the ash difficulty, whatever ash arises sufficiently to reach the top of the fire box must be extremely fine and light; and, if the exhaust passage and smoke pipe are fully open, will be taken off through those appropriate channels. By means of a conduit from the bottom of the ash pan outward and downward to the outside of the hot air chamber, the ashes, etc., may be removed very handily.

As to firing up, a stooping posture is the most tiresome and awkward one for a workman to be placed in; it is far preferable to step up two or three easy steps and then stand upright while putting in the coal.

As to the arrangement of the exhaust valve, this may be placed above and out of any danger from heat, as well as at the side of the engine.

As to supplying coal while the engine is working, this is easily done by means of a receptacle, or hopper, with an inner and an outer door, each airtight. I have two methods of working these doors; there is probably no better mode of working the outer lid or door than the one now in use on the Roper engine; and my plans for working the inner door are nearly as simple, and quite as perfect.

I have great confidence in what is termed the "base burning" plan, as exemplified in the Littlefield and some other stoves, especially for the small engines; could this plan be applied to hot air engines, sufficient coal could be put in at once for a day's work, and, of course, only an outer door to the hopper would be needed. F. G. WOODWARD.

The Nebular Theory and Kepler's Laws.

To the Editor of the Scientific American:

On page 196 of your last volume I attempted to draw attention to, and to promote inquiry as to whether there exists any relation between, the nebular theory and Kepler's laws. I will continue the subject by remarking that a close examination of the inclinations and eccentricities of the orbits of all the planets (including the so-called asteroids, which are really planets), together with the consideration of the active and powerful eruptive forces now known to exist in the sun, strengthens our belief that these laws, as set forth by Kepler, are the result of the development of our present solar system from a single and greatly attenuated mass, as has been supposed by La Place and other eminent astronomers.

Let us examine some of the data on which such belief is based. Beginning at the outer bounds of our system and approaching toward the center, we recognize Neptune, Uranus, Saturn and Jupiter, all large planets, and all having orbits of small inclination and small eccentricity. Just as might be expected, when we consider their great mass and admit the radial force to be small.

Proceeding further toward the center, we find a large group of small planets, more than 130 in number, revolving between the orbits of Jupiter and Mars, in a space where it would appear to be about the place for the throwing-off of another planet. But just at this point a change, perhaps small, seems to have taken place in the eruptive force, seeming to indicate an increase of energy in that force. There here seems to be a throwing-off of smaller masses, at much more frequent intervals and generally with increased radial velocity. And it would also seem as if the equatorial motion of the mass did not so much affect the plane of the projection, as in the case of the larger planets.

From the consideration of the above facts, it would appear as if the eccentricities of the planetary orbits were due to the action of the radial or central force; while the inclinations are due to the exertion of that force in a direction forming an angle with the equatorial plane of the revolving solar mass. We may notice also, in passing, that these radial eruptions would not affect the harmony of the orbital motion of these small planets, as the planet-exploding theory would indicate.

Still proceeding towards the center, we may now assume that the eruptive force again became comparatively quiet, and the detachment of the masses took place more regularly; so that the births of Mars, the Earth, Venus and Mercury took place under conditions similar to those of the earlier and larger planets.

Evidence in favor of the nebular hypothesis is continually accumulating. That afforded by the spectroscope demonstrates that the planets are composed of the same elements as the sun; while the elements in some of the stars are different. This evidence is among the latest, and is probably the most conclusive. Admitting the nebular theory to be true, there is no difficulty in accounting for Kepler's laws. They are what we might reasonably expect to result from a process of evolution as set forth in that theory.

It is extremely interesting to contemplate the possibility of such changes in the solar system and the evolution of so many beautiful worlds from apparent chaos.

Tamaroa, Ill. E. H. PRICE, M. D.

Ignition from Steam Pipes.

To the Editor of the Scientific American:

The Fire Marshal reports 31 fires for the month ending August 16. Among the causes is "heat from steam pipes setting fire to scraps in drying box 1." How do you account for this ignition? It is not probable that any oil was present in a drying box.

New York city. NORMAN WIARD.

REMARKS BY THE EDITOR.—Our correspondent has omitted to mention the nature of the establishment, the scraps or the drying box, in which the alleged ignition took place. These particulars are necessary in order to reach a satisfactory conclusion. We have published examples of ignition in cotton drying and picking rooms, where steam pipes were used and no oil assisted the combustion.

The Proposed Great Telescope.

To the Editor of the Scientific American:

I have read with interest many articles in your journal in regard to the big telescope; but it strikes me there has not been proposed as yet a really efficient and practical instrument, that is, as to form and dimensions.

Why not construct, on a large scale, one of those fine, silvered glass reflecting telescopes, now becoming so popular in England, which, in the hands of both amateurs and experts, are so successfully aiding the science of astronomy? It is possible to construct such a glass of ten or twelve feet diameter, at but little, if any, more than half the price of such a glass as described and illustrated in your issue of August 16, by F. H. R.; while the light-gathering capacity and penetration of the former would be far superior to the latter. Besides, the length of this enormous instrument need not be greater than the five foot glass of the correspondent just mentioned; and its mounting would be as easily accomplished and at as little expense.

The glass, as proposed by your correspondent F. H. R., would be impracticable, though not at all liable to the objection he anticipates in regard to the division marks of the field of view by dark bands. But it would fail because a sufficient number of pieces of glass, of absolutely the same density and homogeneity, would be difficult to obtain, and on account of the extreme liability to unequal expansion of the glass, cement, and iron, which are parts of the lens. The latter would render it almost, if not quite, impossible to secure for it good definition, without which such an instrument would be almost worthless. Opticians and glass manufacturers know that the present state of the art of glass-making does not enable them to obtain single disks out of which good refracting lenses can be constructed larger than of 28 or 30 inches diameter; so an excellent instrument of that kind, known as the achromatic, cannot go beyond that limit. But for a silvered glass or reflecting telescope, plates of glass of good quality can be manufactured of 10, 12, and even 15 feet diameter. And it is but reasonable to presume that an application of some of the extremely fine and delicate methods of producing surfaces on similar smaller instruments, as practised by some of the English and American opticians, would not fail to secure an exquisite figure and surface on even as large a glass as here contemplated. So large an instrument would, of course, be better adapted to the discovery of the physical constitution of the celestial bodies, by means of its wonderful power to penetrate the unfathomable space, rather than to serve the more exact purposes of mathematical astronomy, this latter being within the province of, and almost altogether performed at present with, small instruments especially constructed and arranged for that purpose. I shall heartily approve the big telescope enterprise if it be put on some sound and practical basis.

Springfield, O. F. M. B.

A Suggestion for Balloonists.

To the Editor of the Scientific American:

The existence of an upper southwest current in the atmosphere of the northern hemisphere has been maintained by meteorologists for many years. Espy, Redfield, Maury, Butler, and hosts of other scientists, have expressed their conviction that there is a current of heated air at the equator, which rises there and blows off in the upper regions of the atmosphere towards either pole. These currents proceed from a part of the earth where they are moving rapidly, with the earth's motion, to a point where the motion is slower. Their momentum being retained, they assume an easterly course; and in the temperate zone, they would range, more and more, to the east and north, the farther they go northward. For the same reason, the wind blowing from the north pole towards the equator acquires an easterly direction, and seems to come from the northeast. Our surface northeast wind is cold, dry, and heavy. It makes the barometer rise because it is heavier. It chills us with cold from the snow. Its moisture has been frozen out of it. The southwest upper current is warm, moist, and light, and all its effects are the reverse of those of the northeast wind.

The evidence and reasoning satisfy me that there is a southwest upper current. The movements of the clouds show at all times three or four currents; they move in strata, often directly opposed to each other, one above going westward and one below going eastward.

It is manifest that a balloonist can move in a given direction by keeping his balloon in the current, and in that way only. To keep in the current, the balloonist must be able to rise or descend at will. This power Professor Wise has not. He can go up as high as he wants, and he can come down. But having gone up and come down, he cannot go up again. This is the trouble in balloon traveling. It is singular that no effort has been made to remedy this difficulty, except by means of ballast and valve ropes. There are several ways in which it might be done.

Instead of ballast, sand bags, etc., let the aeronaut take strong vessels, like soda fountain chargers, filled with condensed hydrogen, and an air pump for condensing. If the gas of the balloon has leaked, supply the loss from the reservoir. If it needs less buoyancy, withdraw the gas through the air pump, and store it for future use. He can thus be enabled to go up and down several times, and be able to select a particular current on which to sail. With this power at command, there may be some chance for success. He may move up and down till he strikes the right current, and may be able to keep in it till he can reach his destination. J. W. SKINNER

Yonkers, N. Y.

© 1873 SCIENTIFIC AMERICAN, INC

THE IRONCLAD HULLING STONE.

The hulling machine, to which the improved stone herewith illustrated is designed to be applied, is composed of a revolving stone contained in a fixed perforated case. The former is dressed on its edges and has grooves in its bottom in order to excite a blast, so as to spread the grain between stone and case and retard its descent to the bed plate. The improvement in the present invention consists in lining the vertical edges of the grooves with metallic plates, in order to prevent the stone, which is generally of soft nature, from being worn away at such edges through kernels of grain getting between the same and the bottom plate. In Fig. 1, showing the stone reversed, A is the flange, made of the best cast iron, fitted and secured into a recess in the center, as shown. The spaces between the edge of this flange and the stone are filled with lead or brimstone. Through the center opening passes the spindle, on a shoulder upon which the flange rests and is secured by keys. Air is drawn in under the stone through a large aperture cut through the bed plate and platform in the center. The grooves taper in depth from the edge inward, and their vertical sides operate as a fan blower, forcing a strong blast of air toward the circumference, driving the grain the full hight of the periphery of the stone. Slides are arranged under the air orifice to regulate the draft. It is claimed that a four foot stone, fed by charges and revolving at two hundred and fifty revolutions per minute, will drive every kernel out through the discharge slide within three seconds.

The principal advantage claimed for the metal bars or facings, B, consists in the fact that the distance between stone and case need not be over one quarter of an inch. The blast has always to break at a very short angle after entering, so that, no matter how strong it may be, it cannot prevent scattered grain from getting under and wearing away the groove edges. To avoid this difficulty, similar machines are ordinarily made with a clearance of three quarters of an inch or an inch. This, according to the inventor of the present device, renders them incompetent to hull dried oats or tender grain without great waste, because the material is not spread evenly, and is caused to lie between stone and case in bulk. The edges, being guarded as above described, are, in the invention under consideration, not liable to such wear; and hence all grain, it is stated, is evenly distributed and hulled.

The bars B, are secured by eyebolts C, Figs. 2 and 3, hooked over a recessed portion of the former and then passed through suitable holes and secured by a nut and washer on top of the stone. The bars can thus be readily detached and shortened as the diameter of the stone diminishes by dressing. Patented June 10, 1873. For further particulars address the inventor, Mr. A. Bertelson, West Salem, La Crosse county, Wis.

Fig. 1

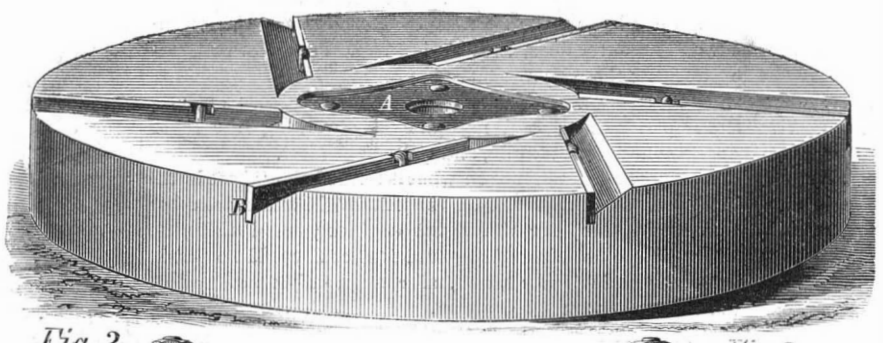


Fig. 2

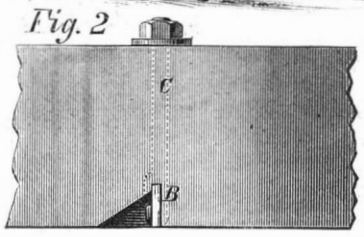
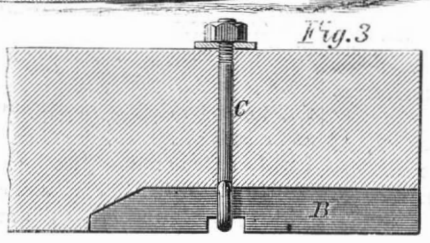


Fig. 3



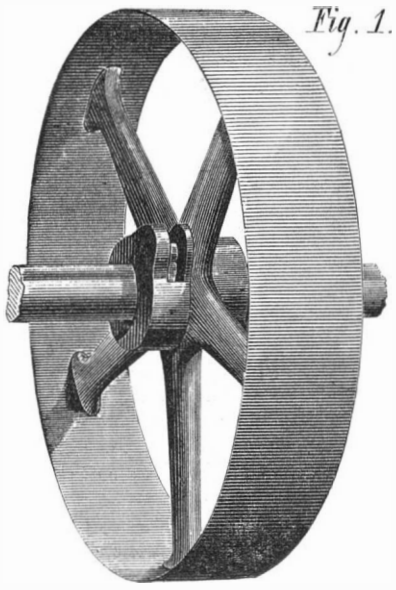
BERTELSON'S IRONCLAD HULLING STONE.

The patent, obtained through the Scientific American Patent Agency, July 8, 1873, is, we understand, for sale, and the model will be exhibited at the coming Fair of the American Institute in this city. From the inventor, Mr. Giles P. Potter, Coventry, Kent county, R. I., further particulars may be obtained.

IMP OVED FRICTION ATTACHMENT.

The accompanying illustrations represent a new mode of securing pulleys, couplings, etc., to shafts.

Fig. 1.



Apart from the practical utility of this invention, it is claimed to possess the merits of economy and simplicity of construction, which render it much cheaper than any other

Fig. 2

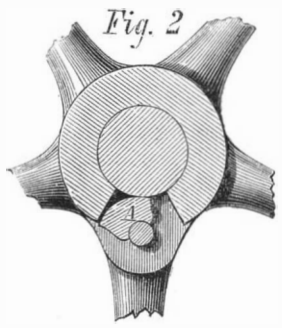
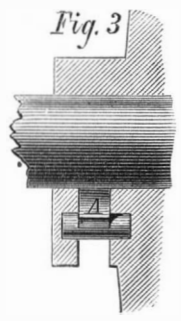
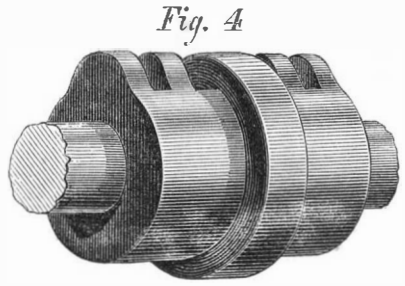


Fig. 3



fastening now in use for the same purpose. If the castings are turned out properly (which requires no particular skill in molding, and but very little additional labor), no further

Fig. 4



work is necessary, as the device merely consists in a pin, cast in the lug, upon which is placed a small cam, which works in a space provided for the same.

Fig. 1 represents a pulley with a fastening of this kind. Figs. 2 and 3 represent sectional views of the hub of the same, through the cam, A, showing the action of the latter upon the shaft. The cam or cams on the pulley or coupling, being turned, create the friction or grip, by which the pulley or coupling is held, and which increases in proportion to the amount of force exerted; consequently the pulleys, etc., are held firmly upon the shafts. When pulleys are required to work in opposite directions (which is not often the case), reverse cams will be used.

This device, applied to shaft couplings, it is claimed, will effect even a greater saving than when applied to pulleys, as the couplings will be in one piece, doing away with the labor of facing, the expense of bolts, etc.; and as the flanges will be dispensed with, less weight of metal will be used. Still further, if properly cored, the boring also may be saved.

This invention, we are informed, possesses not only the quality of self-tightening (which, in itself, is an important consideration, especially where access to the means of fastening is difficult), but it can also be easily loosened when it is desired to remove a pulley to another part of the shaft; it is claimed, therefore, that a great deal of labor, which usually attends such operations, is dispensed with. It is further claimed that it does not prove injurious to shafts, as is the case with set screws, especially on their giving out, an annoyance which is too often experienced by those who use them in cases where much power is required to be transmitted. This quality particularly adapts its application to pulleys on cold rolled shafts; as in such cases, key seats, etc., are objectionable, as breaking the surface causes them to warp. Fig. 4 shows the invention as applied to a shaft coupling, two mortices being made, on either side of the center.

We are informed that actual trials, by a brake on the surface of a pulley provided with the device, failed to loosen the latter, and caused a scarcely perceptible indentation on the shaft. The invention is in successful operation in various localities in Canada.

For information regarding sale of shop rights, etc., address the patentee, Mr. Henry W. Cox, Peterborough, Peterborough county, Ontario. Patented through the Scientific American Patent Agency, June 10, 1873.

IMPROVED WINDOW WEATHER STRIP.

This invention is a combination of both sash holder and weather strip. It serves, therefore, not only to caulk the

Fig. 1.

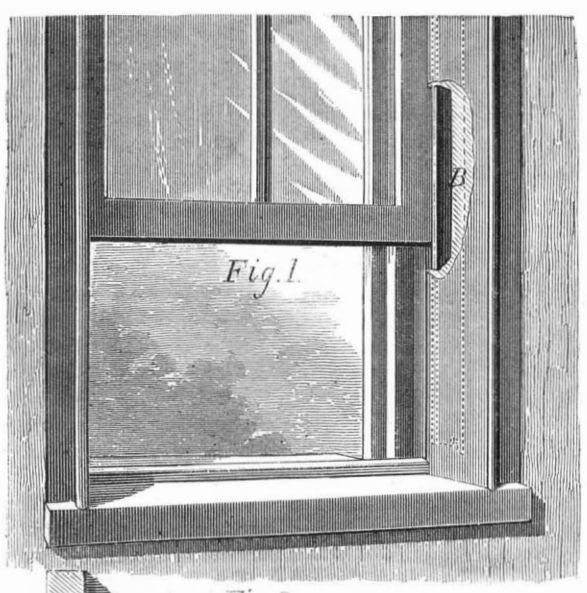
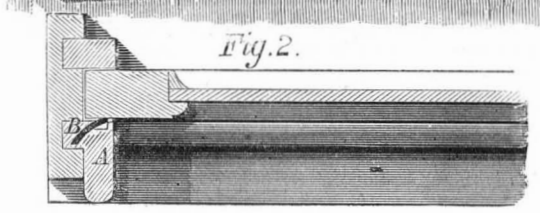


Fig. 2.



edges of windows, preventing the entrance of cold air or dust, but also as a convenient attachment for sashes unprovided with cords and pulleys.

Fig. 1 depicts the device in position, part of the window casing being broken away to show the india rubber packing. Fig. 2 is a horizontal section of the sash and surroundings, in which A represents one of the vertical battens or guide strips. These are right angled in section, one part fitting in a vertical groove, and the other portion against the inner side of the casing. In each, and on the side facing the sash, is formed a recess corresponding in depth to the thickness of the rubber strip, B. The latter is fastened in an oblique extension of this recess, by glue, nails, or other suitable means. The front end of the strip projects at an angle above the batten, and is pressed back into the straight portion of the recess, when the sash moves over it. It therefore acts as a spring, holding the sash in any position, allowing the same to be easily and noiselessly opened or closed, while it effectually packs the interstices between sash and frame.

The advantages of the invention are its simplicity and the fact that it is a substitute for both detachable weather strips and the button or other arrangement usually employed to sustain the sash.

IMPROVED WRENCH.

Any one who has ever removed the wheels of a carriage to oil it, will at once appreciate the improvement which the annexed engraving illustrates. An ordinary wagon or carriage wrench is cast with a slot in one side of the square, in which a small elastic rubber roller, A, is hung, extending into the open space far enough to pinch the nut so that it will remain firmly fixed in the wrench when it is removed from the axle. There is also a handle, B, Fig. 2, projecting from the shank a short distance from the box and at right angles with it, by which the nut, when loosened, is rapidly turned off with a crank movement. The handle also serves to steady the wrench, keeping it from slipping from the nut while being loosened, when, as is frequently the case, it has become very tightly screwed on. This improvement supplies a cheap and, doubtless, efficient wrench which, it is claimed, renders the usually tedious and dirty operation of oiling or greasing rapid and cleanly. With it there need be no rapping of the knuckles, no dropping of the nut and final replacing with the fingers, which so exhaust the patience and ruffle the temper.

Fig. 1

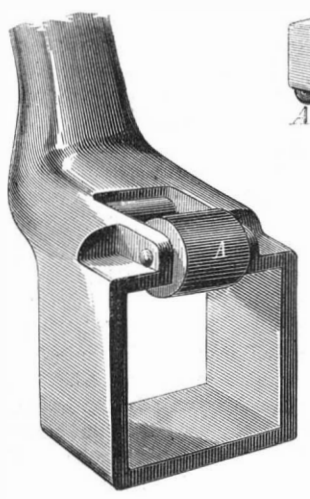
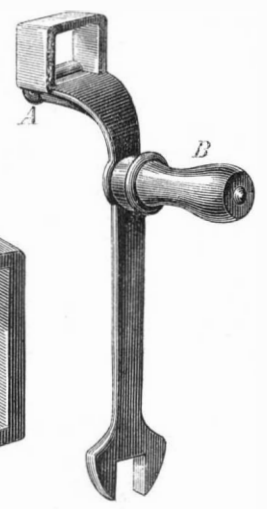


Fig. 2



For further information address the manufacturer, N. L. Post, P. O. Box 52, East Cleveland, Ohio, by whom it was patented February 11, 1873.

AT the Patent Office, Washington, every examiner is now favored with the help of a lady clerk, who takes charge of the official correspondence and looks after the odds and ends of the examiner's business. There is one exception, however. The examiner of medical inventions is debarred from feminine assistance, and is compelled to keep a clerk of the masculine gender.

© 1873 SCIENTIFIC AMERICAN, INC

KANSAS CITY, MO., AND ITS COMING EXPOSITION.

There are probably few localities which more substantially typify the rapid growth, both in population and material prosperity, of our Western towns than Kansas City, Mo. In the year 1855, its inhabitants numbered but 600, and this figure, up to the taking of the census in 1860, had increased to 4,318. In the ensuing ten years, the latter total augmented over six hundred per cent; while at the present time it is estimated that the population aggregates over 40,000 souls.

Situated in Jackson county, on the right bank of the Missouri river, Kansas City forms the terminus of nine distinct railways; in addition to which, there are three lines entering on the tracks of others, and four new roads in progress of construction. The completed routes are the Missouri Pacific, the St. Louis, Kansas City, and Northern, the Hannibal and St. Joseph, the Kansas City and Council Bluffs, the Missouri Valley, the Kansas Pacific, the Leavenworth, Lawrence, and Galveston, the Kansas City and Santa Fé, and the Kansas City, Fort Scott, and Gulf. Those upon the tracks of others are the Toledo, Wabash, and Western, the St. Louis, Alton, and Chicago, and the Kansas City and Louisiana. The new lines are the Kansas City, Memphis, and Mobile, the Kansas City and Keokuk, the Kansas City, Wyandotte, and Northwestern, and the Kansas City branch of the Atchison, Topeka, and Santa Fé. A fine railroad and wagon bridge, built at a cost of $1,000,000, and the first ever constructed across the Missouri, spans the river and supplies another means of access to the city.

It may readily be imagined that so many concentrating lines of railway—a noticeable fact in connection with which is that not one was in operation at Kansas City before the spring of 1865,—attracted as they were to this locality as a point of reshipment and a market for the rich mineral and agricultural resources of the surrounding country, have been largely contributive to its prosperity. This result has been rendered still more beneficial from the fact that a competition has been engendered between the railways and the river boats, a circumstance which has led to the cheapening of freights to a degree below those to any other point West, and hence has given to the trades and manufactures of the city a vigor and strength rarely found in new established towns.

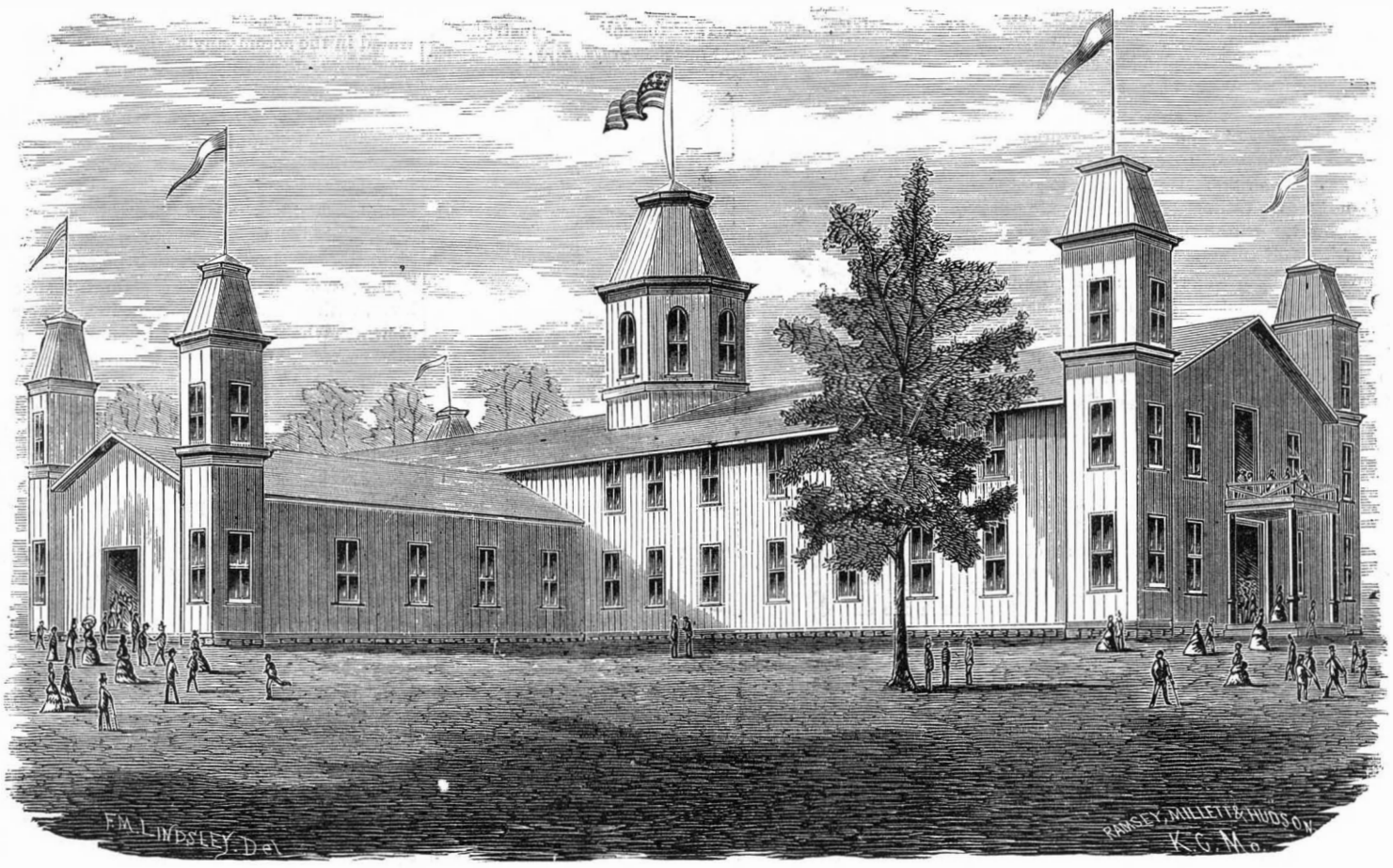
As regards the industries of the place, among the most important is that of packing cattle and hogs, twice as much live stock, it is said, being there slaughtered as in any other city of the Union. In 1872, 187,221 hogs were packed; and we understand that the business, owing to increased facilities, has been carried on during the present year on a largely increased scale.

Although founderies, mills, furniture factories, and similar establishments are well represented, it seems that there is abundant room for many others. Starch works and distilleries are needed to manufacture the surplus corn. Tanneries, glue, and comb factories are also and even more urgently required; for although Kansas City exports hides, horns, hoofs, and bones, the finished staples of sole leather, glue, bone buttons, etc., are imported in great profusion. Smelting works and white lead mills will also find an abundant field for operation. There is a plentiful supply of coal; and from the proximity of the town to the mines of Colorado and Utah, and the minerals of the Ozark range, there seems no reason why a large share of the business of smelting, which now, at enormous expense, finds its way across the continent, and even to Swansea, in Wales, should not be done here. In fact, there is every pre-requisite at hand for a great manufacturing city and a market of almost unlimited extent.

In order to stimulate local energy and, at the same time, to draw the attention of the rest of the country to the rich resources in the neighborhood, the citizens of Kansas City have, for three years past, held an Annual Exposition and Agricultural Fair, which has been the means of attracting large numbers, both of spectators and exhibitors of stock, agricultural machinery, products, etc., from all parts of the United States. A fourth exhibition will take place during the coming fall, and the managers, we understand, have secured liberal arrangements for transportation of freight to and from the Fair. They offer to handle and display, free of charge, all articles consigned to them, and will repack and return the same to such owners as may be unable to attend in person.

We give herewith an engraving of one of the ample buildings, in the number of which are included power, fine art, and agricultural halls. The grounds comprise 97¾ acres, laid out with groves, race tracks, and every attraction and convenience. By addressing Mr. D. L. Hall, the secretary of the expostion, at Kansas City, premium lists and more detailed particulars may be obtained.

It seems to us that this Fair is well worthy of the attention of manufacturers and others, who propose to contribute this year to the various expositions throughout the country, particularly as they incur little or no expense in forwarding their goods to a locality which will doubtless prove an excellent market.



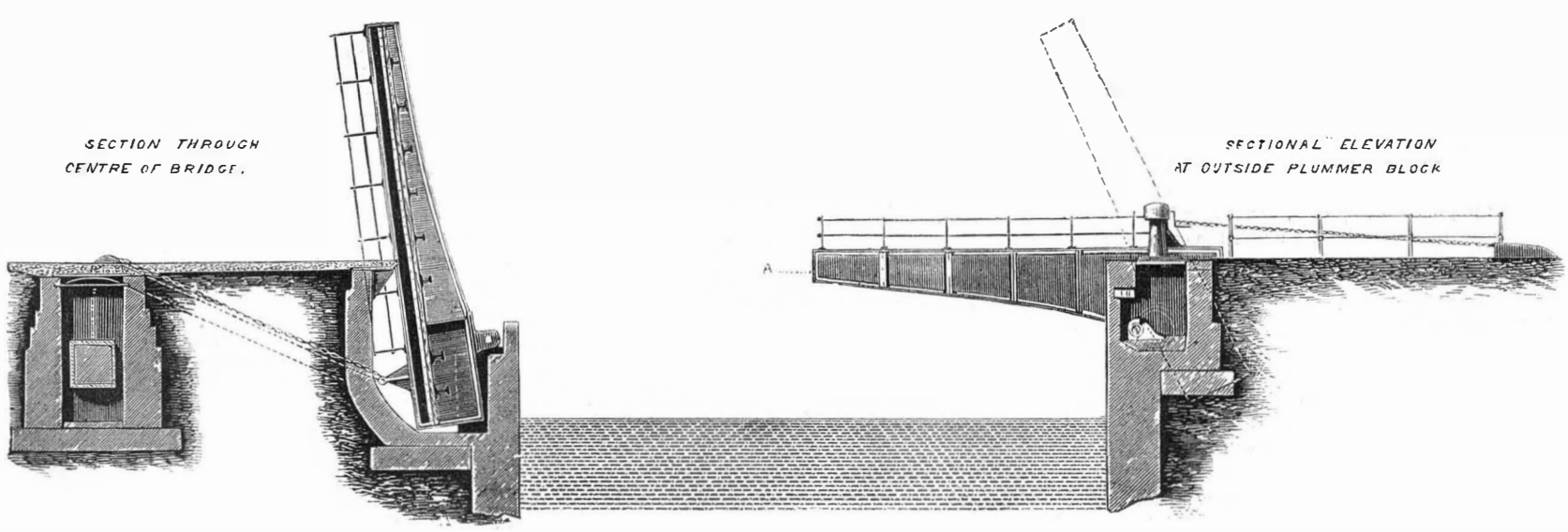
MAIN BUILDING OF THE KANSAS CITY, MO., EXPOSITION.

The Projected Indo-Russian Railway.

The new railroad projected by M. Ferdinand de Lesseps is to extend from Orenbourg, Russia, on the line of separation between Europe and Asia, and Peshawur on the confines of Afghanistan, thus forming a direct route, connecting the center of Asia with the northeast of Europe. Orenbourg is now the terminus of the system of Russian railways, while Peshawur is the starting point of the Anglo-Indian lines. The distance between the river Ural, on which the first of these towns is situated, and the Pass of Khyber, near the second, measures about two thousand three hundred miles. The junction of the Anglo-Indian and Russian lines will be at Samarcand, in Bokhara. When this great road is completed, there will be seven thousand five hundred miles of continuous rail between Calais, France, and Calcutta, making the time required to reach the latter city, from New York, about twenty days.

COUNTERBALANCED LIFTING BRIDGE.

This invention, patented by Mr. Walter Browne, C. E., and described in the *Engineer*, relates to the class of bridges which are opened by being lifted into an erect position, after the manner of the ancient drawbridges. In order to facilitate the operation of lifting, it is usual to make the jib end and heel end of the bridge balance each other round the shaft or axle. It is in the arrangement of this counterbalancing that the present invention consists. The counterweight in this case is not attached to the bridge so as to form part of it, but is contained in a separate pit or chamber placed some distance behind the heel of the bridge. This counterweight may consist of a cast iron box filled with sand, water, or other convenient material. To each end of this box a chain is attached which passes over a pulley at the top of the pit or chamber, and is thence led to the point of attachment to the bridge. This point of attachment should be over the axle of the bridge and at a considerable hight above it, so as to give a suitable leverage to the pull of the chain. This hight may be obtained by placing the axle below the bottom of the bridge girders, and by using a bracket or standard bolted to the top of the outside girder, to which the chain may be attached. It will then be seen that, supposing the moment round the axle of the weight of the bridge to be equal to that of the pull of the chain when the bridge is down, then, as soon as the bridge is raised, the moment of the pull, acting at a longer arm, will be greater than that of the weight, and will therefore continue the motion of itself. The point of attachment should be so arranged that, when the center of gravity of the bridge is ver-



BROWNE'S COUNTERBALANCED LIFTING BRIDGE

© 1873 SCIENTIFIC AMERICAN, INC

tically over the axle, the line of the chain produced may also pass through the axle or nearly so, so that the two moments may be zero about the same time. From this point the moment of the chain, still acting in a contrary direction to that of the weight of the bridge, will tend to stop the bridge, or to destroy the motion previously given; and as it will again have a preponderance over the moment of the weight, the bridge may be brought to rest in its proper position when fully open. In closing the bridge the same effects will be produced, the counterweight accelerating the motion of the bridge in the first half of its travel and retarding it in the second, so that it may be brought to rest in its original position.

In order to obtain some *data* for comparison, the bridge has been taken for which the invention was originally designed, namely, a two leaf bridge, 28 feet wide out to out, spanning a 40 feet opening. An estimate has been made of the cost of this bridge on the counterbalanced system, as compared with that of the other types of bridge which might be employed, with the following results: The counterbalanced bridge costs 15 per cent less than an ordinary lifting bridge or a rolling bridge, and 34 per cent less than a swivel bridge; there would also be considerable economy in working, and the new device would, by its construction, be less affected by the wind, when elevated, than the lifting bridge.

Injuries of the Ear.

"Among the causes of injury to the ear must unfortunately be reckoned bathing. Not that this most important and healthful pleasure need, therefore, be in the least discouraged; but it should be wisely regulated. Staying too long in the water certainly tends to produce deafness as well as other evils; and it is a practice against which young persons of both sexes should be carefully on their guard. But independently of this, swimming and floating are attended with a certain danger from the difficulty of preventing the entrance of water into the ear in those positions. Now, no cold fluid should ever enter the ear; cold water is always more or less irritating, and, if used for syringing, rapidly produces extreme giddiness. In the case of warm water, its entrance into the ear is less objectionable, but even this is not free from disadvantage. Often the water lodges in the ears and produces an uncomfortable sensation till it is removed; this should always be taken as a sign of danger. That the risk to hearing from unwise bathing is not a fancy is proved by the fact, well known to lovers of dogs, that those animals, if in the habit of jumping or being thrown into the water, so that their heads are covered, frequently become deaf. A knowledge of the danger is a sufficient guard. To be safe it is only necessary to keep the water from entering the ear. If this cannot be accomplished otherwise, the head may be covered. It should be added, however, that wet hair, whether from bathing or washing, may be a cause of deafness, if it be suffered to dry of itself. Whenever wetted, the hair should be wiped till it is fairly dry. Nor ought the practice of moistening the hair with water, to make it curl, to pass without remonstrance. To leave wet hair about the ears is to run great risk of injuring them. In the washing of children, too, care should be taken that all the little folds of the outer ear are carefully and gently dried with a soft towel."

A correspondent sends us the foregoing, clipped from a newspaper, and asks our opinion thereon. He adds: "I am partially deaf (doctors say from cold), and I was told that bathing my ears in cold water was good, being a sort of a stimulant. I can hear very well in a machine shop, or traveling on the cars, the jarring noise causing the drum of the ear to vibrate and allowing sound to enter."

REMARKS BY THE EDITOR:—The statements contained in the above paragraph are quite correct; and, it might be added, of practical value. The ear is quite as liable to injury from drafts of air as from cold water. The modern style of cutting the hair in men, and of arranging the hair of women, is much to be deprecated; because it was intended by Nature that the hair should fall over the ear, and form thus a protection to it. But as we cannot throw down so great a goddess as fashion, we must use care and artificial means for the preservation of this delicate organ.

If sitting in a draft is unavoidable, the handkerchief should be applied to the ear exposed, or a pledget of cotton inserted within it. The ordinary manner of washing the face does no harm to the ear, because the canal leading to the drum of the ear is partially occluded by wax, and water does not penetrate far; but all swabbing of the ear, whether with dry cloth or lint moistened with hot or cold water or other fluid, is by no means to be advised, as it removes the wax, the necessary safeguard to the internal ear.

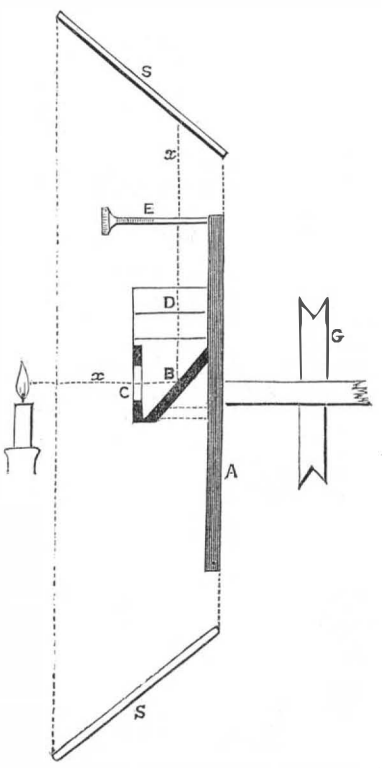
Our correspondent is suffering probably from a thickening of the epiderm's of the tympanum, caused by chronic inflammation, set up, perhaps, by cold, but it may be by other irritation. He should place himself under the care of some competent aurist, and not attempt to doctor himself.

The Nature of Infection.

Investigations, says Dr. J. J. Brown, result in establishing these facts: There are low forms of life, some of which can and some of which cannot be seen with the microscope. More than thirty varieties of these infest the human system. They permeate the fluids and solids of the body. They are known to be the cause of some diseases, which makes it possible that they are the cause of others. The cause of infectious diseases is obscure. Probably they are caused by species of parasites. This supposition matures into an established fact when supported by the following truths: Under the microscrope of Chaveau, the active principle of infection is a solid granule. Such remedies as are most destructive of parasites are most efficacious in communicable diseases. The cause dies; only living things are subject to death. Lostorfer shows them or their germs actually to exist in the circulating blood.

New Optical Instrument to Exhibit the Mechanical Combination of Colors.

Frederick J. Smith has designed the following instrument, which he describes in a recent number of *Nature*:

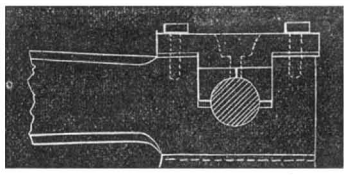


To the center of a disk, A, which can be caused to revolve by the wheel, G, a plain mirror, B, is fixed at angle of 45° to the surface of the disk. In front of the mirror is placed a prism, D. At the edge of the disk there are placed different slides, E, for cutting off any particular rays; also, above the mirror, is a small slit cut in a piece of brass, C, to admit the ray under examination.

x x is a ray of light which, passing through the slit, C, is deflected at right angles by the mirror, B, through the prism, D, and is then received in the form of a spectrum upon the screen, S S. As soon as the wheel, G, is set in motion, the spectrum also moves round the conical screen, S S; and when a certain velocity is arrived at, the colors combine and form the original colored light which is entering at the slit, C. In the same way, by using the slides, any two or more colors may be combined to form the resultant color.

A Good Journal Box.

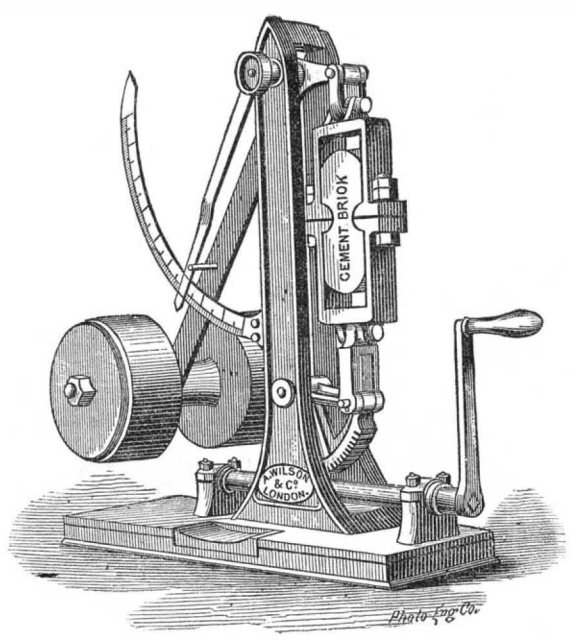
A correspondent, Mr. C. W. Crawford, of Brazil, Ind., makes the following suggestion for a journal box, and hopes the mechanical profession will avail themselves of it.



He claims the advantages of simplicity of construction and, consequently, cheapness. The side brasses are of such shape as to always take up the wear both horizontally and vertically, by simply screwing down the cap, without the use of liners, wedges, set screws, etc. The journal, being held at three points nearly equidistant, entirely reduces the liability to thump or pound. The box may be fitted with bottom brass or lined with Babbitt metal, according to circumstances. Mr. Crawford states that this is the best main journal box now in use for steam engines.

IMPROVED TESTING MACHINE.

Among modern refinements in the art of construction must be placed in the foremost rank the experimental determination of the cohesive strength of materials under strain. The nice adjustment of dimensions and constructive parts is a corollary of such a knowledge of the ultimate strength of bodies, involving economy of material and



cost. The bearing thereof upon the stability of structures is of essential import; and as a fortress is no stronger than its weakest point, so, whatever be the powers of resistance of the constituent elementary parts of any structure, such as the stones and bricks, it is essential that the medium of union, or vehicle, as painters might call it, should be at least of equivalent strength.

Usually, however, the absolute and relative strengths of the cement or mortar, that converts the separate elements into the combined whole, are very much matter of chance and guesswork; hence results a waste of power or an increase of risk. As a factor in construction, however, the strength of cements and mortars has come to be regarded as a fit subject for actual determination, and the machine illustrated in the accompanying engravings aims at placing the means of test in every one's reach. It is the patent of Messrs. Michele and Carrington.

Sample blocks, grooved as shown, are formed from the cementitious material required to be tested, and allowed to set and become dry. After a sufficient interval they are placed in the corresponding and suitably formed jaws of the testing machine, the lower jaw being pivoted to one angle of a toothed quadrant, movable by worm and hand wheel, and pivoted on bearings in a pair of parallel standards. The upper jaw is similarly affixed to the short bent arm of a lever, with fulcrum pin carried in the same standards, and of which the long straight arm carries a heavy counterbalance weight; the weighted arm works against a fixed graduated arc carried by the standards, which rest on a bed plate. The jaws are also connected and united by bolts and nuts, which are not screwed home, so that a little play is allowed for the fracture of the cement block, to the extent of one sixteenth of an inch or so. Attached to the weighted arm is also an index pointer, capable of being raised, but not depressed, with it.

The action of the whole apparatus, for the illustration of which we are indebted to *Iron*, is very simple and effective the cement block or other material to be tested being placed within the jaws, the hand wheel is turned, which, operating by the toothed quadrant, draws down the block, jaws, and short lever arm, causing the weight to move outwards and upwards, thereby exerting an ever increasing strain upon the block of material undergoing test, and of which the resistance must eventually be overcome, resulting in fracture; whereon the weight, being released, drops back until caught and retained by the bolts and nuts uniting the jaws; but leaving the pointer to indicate the breaking strain upon the graduated arc. The peculiar feature of this apparatus is the gradual application of, and increment in, the strain applied, avoiding all jerk or uneven strain, which might exaggerate the breaking effort and yield untrustworthy results.

The Average Migratory Mechanic.

"Forfex" sends us the following portrait, evidently taken from life:

The average migratory mechanic, with great self-abasement, applies to the master mechanic of the shop for work. This gentleman, though regarding him distrustfully on general grounds, from press of work in the shop violates his better judgment, employs him conditionally, and submits him to the foreman, who conducts him to his station. New man scrapes acquaintance with nearest workman by remarking casually: "Work must be looking up in this establishment," and adds ostentatiously: "The old man sent for me to New York, and would not take no for an answer; so to quiet him, concluded to stay till he can get another man in my place. Vessel's on dry dock any way for two months. 'What vessel?' Why, Blue Warrior; chief engineer. Run Uncle Sam's blockade in her during the war;" and, winking confidentially to listener, who begins to feel an interest in him, signifying thereby his desire for secrecy on that point, continues: "Two thousand dollars prize money home. Ain't got a spare pair of overalls till trunk comes from city? Thank you. Do 's much for you some time. Ever been in Halifax? I built nine locomotives for railroad there. Had ninety men. Ever go there I'll give you a line to boss of whole concern. It 'll get you a job on sight. Pretty good lathe this. Always did like to run a double ender. Man ain't liable to get dozy. Lost eight hundred dollars once on contract for building tools for navy yard. Woman, you know! Went to sea. Think I'll recover it, though. Applied to old man there. Says show 's good. Know in four weeks. Write to him to-night. Tell him to send letters to this place for next two months. Ain't got four dollars in your clothes? Expect package of tools by express, and mate of the vessel's going to send lot of the best tobacco. Smuggled. Thank you. Bet you'll lose nothing by this. You're like Sam Cunard. Bully fellow. Father's rich. Seconded me once at a little mill. Police always around when they're not wanted. Got any tobacco till mine comes? Solace or Century? Both good. When I was in Cuba," etc., etc. New man ingratiates himself into the confidence of all he can, borrowing as much as possible from his too credulous shop mates, talking away his employer's time, and sequestering his carelessly done work: until at the expiration of two weeks an envelope, containing his wages to date and dispensing with his services, is laid on his lathe. Morning discovers to the widow lady with whom he boarded that he has flown in the night; and upon this being understood at the shop, there is, straightway, mental resignation of sums of money, light tools, clothes, and tobacco."

BORAX IN CALIFORNIA.—Discoveries of borax in California and Nevada have been made to such an extent as to warrant the belief that from these sources the markets in the east of the American continent will, at no distant time, be able to draw their chief supplies.

A WRITER in the Oneida *Circular* recommends saw dust as a substitute for stockings. A tablespoonful of the dust in each boot will do, keeping the feet dry and warm.

© 1873 SCIENTIFIC AMERICAN, INC

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The annual meeting took place at Portland, Me., August 20, under the presidency of Professor Joseph Lovering.

Ex-President Hill, of Harvard, read a paper on a mathematical subject, and Professors Young and Hough described their different devices for controlling, by an electric current, the movement of the chronograph. Hon. E. B. Elliott, of the Treasury Department, read a paper on the relation of the frequency of auroras to changes in the length of the earth's radius-vector. "The association of the aurora with electrical or magnetic changes or disturbances in the earth's crust is well understood as invariable. The difficulty of working the telegraph during intense auroras demonstrates this truth. We cannot say that the atmospheric disturbance—the aurora—causes the earth's disturbance; we cannot say that the terrestrial disturbance causes the aurora. Possibly they may both be effects of some cause yet undiscovered. The surface of the sun is subject to vast disturbances, as is manifest by the spots which appear and disappear so suddenly. Hence the amount of radiated heat, no doubt, varies greatly. In these varying thermal conditions, we have the efficient causes of magnetic disturbances. An investigation of the recorded observations of auroras, published some years ago by Professor Lovering, shows that the maximum number were seen in the month of October, and the minimum number in March, the number declining from the former date and increasing from the latter. These months mark the extreme points of the earth's orbit; hence, in these varying thermal conditions we have, if not a cause for the aurora, at least a most remarkable coincidence."

Professor Wm. A. Rogers, of the Harvard Observatory, detailed the results of many ingenious devices designed to render more delicate and exact the various instruments of astronomical investigation. His special purpose was to obtain a substitute for the "spider lines" of the telescope. This he finds in a set of lines etched upon glass by hydrofluoric acid, and rendered opaque by "filling" with plumbago. The process is too intricate for description without the beautiful specimens of etching on glass, which were exhibited. Quite a lively and somewhat dashing discussion followed among the star gazers on the value of certain refinements of modern instruments, Professors Hough, Hilgard and Young taking part.

Professor Putnam, of Salem, presented a statement of his investigations upon a curious fish, the liparis, which has for a long time been a subject of special interest among zoölogists.

Professor T. Sterry Hunt very ably discussed the geology and economic mineralogy of the southern Appalachians. After sketching, in a clear and comprehensive manner, the geological origin of the great Appalachian chain, he pointed out the curious decay to which the micaceous and schistose rocks, which compose the great mass of these mountains, is subject, producing what is popularly known as rotten rock, which it really is. While the drift somewhat uniformly covers the surface of the Northern States, it does not extend south of the southern line of Pennsylvania; and hence in the Southern States the soil is the direct result of the decomposition of the rocks underlying that locality. A great variety of valuable economic suggestions were deduced from these observations.

A debate arose between Colonel Whittlesey and Lewis H. Morgan, Esq., on a paper read by the former on the ratio of increase in the human race, with its bearing on the date of its origin. The special point was as to the probable number of the Indian population at remote periods, the reader claiming a high number, from which Mr. Morgan most ably dissented, his extensive erudition on that subject rendering him, perhaps, the best authority in the country.

FOREIGN APPRECIATION OF AMERICAN INVENTIONS.

Mr. Moses G. Wilder, of 121 Chambers street in this city, has, we learn, contracted with the Farrel Foundery and Machine Company, of Waterbury and Ansonia, Conn., to manufacture his machines, he having purchased the patterns and drawings from the New York Steam Engine Company.

Since the illustration of these valuable inventions in the SCIENTIFIC AMERICAN, Mr. Wilder states that he has received repeated requests from foreign periodicals for the privilege of presenting the devices in their pages for the instruction and benefit of their readers. The fact of *Engineering*, of London, publishing a full page engraving and description, and other journals which rarely allude to tools designed abroad making similar offers, free of any expense, indicates the estimation in which improved American inventions are held in other countries, and is a substantial recognition of the merits of these particular machines.

The Mennonites.

What with the proposed advent of several thousand English laborers and the contemplated immigration hither of 150,000 of the better class of Russian peasantry, there is an encouraging prospect for the settlement of our western territory, and its rapid development by a very superior class of colonists. The Russians, otherwise known as Mennonites, leave their country on account of religious scruples, the tenets of their sect preventing them from doing military duty. In brief, they are an order somewhat similar to the Quakers. They come from the valley of the Vistula river, which they have thickly settled and cultivated, showing, by their progress both in industries and education, a marked difference from the ordinary type of continental peasants.

A delegation has recently visited Colorado, Texas, Minnesota and parts of Illinois, searching for suitable lands upon which to locate the colony. The railroads have of course held out every inducement; and it is understood that there will be several settlements along some of the principal lines. A second deputation of about 100 lately arrived in this city, and is composed mostly of young men with their families. It is hoped that a body numbering over five thousand will emigrate by May next.

Remarkable Railway Disasters.

A collision recently took place on the Chicago and Alton railway between a passenger express train running at the rate of 35 miles an hour, and a coal train, of thirty-five cars, running at a speed of 20 miles an hour. Neither of the engineers saw the other's engine until it was too late to reverse, a fact accounted for by the curve in the road, and partly by the dense fog. The two trains came together with fearful force. Being on the curve, however, both engines left the track and passed each other, that attached to the coal train striking the baggage car a few feet from the end, breaking the coupling between it and the smoking car, which the engine struck square in the end, and with such force as to throw the forward end in the air; so that the engine ran under it, tearing the floor completely out and hurling the fifty or sixty unfortunates who were in the car in a struggling mass to the lower end, where there was no chance for escape, and then ensued a scene of horrors which cannot adequately be described. The smoke stack and dome of the engine were knocked off by the collision, and broken timbers of the smoking car penetrated the boiler, letting loose a dense volume of hot steam, which poured into the car, blinding and scalding the helpless inmates, who with shrieks struggled vainly to extricate themselves. Eleven persons were killed and thirty-five dreadfully injured.

ANOTHER STRANGE DISASTER.

On August 19 at 3 40 A. M., on the Great Western Railway, Canada, when the New York express train approached the Welland canal at Thorold, the draw happened to be open. The regulations of the road and the law require the full stoppage of all trains at all draws, but in this instance, to the astonishment of everybody, the train kept on at full speed and plunged into the canal. The train was drawn by two locomotives, and consisted of several baggage and express cars and an unusual number of passenger coaches. Both engines and all the baggage and express cars plunged into the canal, filling the chasm so that there was not room enough for the passenger coaches, and thus all the passengers and employees escaped injury. The disaster was due to the following singular occurrence: Just as the locomotive reached the bridge, the water gage glass in front of the fire box of the engine burst, instantly filling the cab with steam and boiling water, so alarming the engineer that he jumped before bringing his engine quite to a stand.

A Lightning Freak.

The Pittsburgh *Dispatch* says: "During a recent thunderstorm near Oil City, a large tank owned by Mr. J. S. McCray was struck by the lightning. It is a 10,000 barrel iron tank, and contained 3,000 barrels of oil. The bolt struck the top of the tank at the edge, and ran completely around the periphery of the top, cutting off the head of every bolt that fastened the top to the side. The top was raised about two feet by the concussion, and the oil took fire, sending an immense body of flame high in the air. In an instant the top fell back to its position, instantly smothering the fire inside. The oil burned off the tank and then went out, and no further damage was done. The cover was not two inches out of its original position after its fall."

REMARKS BY THE EDITOR.—In this case, the lightning simply ignited the explosive mixture of air and vapor contained in the tank, producing an explosion, the sudden force of which was just sufficient to cut the fastening bolts and slightly lift the cover, without projecting the latter into the air. The lightning, we think, did not run around and cut the bolts as above described.

The Sierra Madre Tunnel.

The commencement of this enterprise has created less noise than one would expect from such a huge undertaking. Yet if it should be only partially successful, not reaching the other side of the range for years to come, the tunnel promises to become of the greatest value in the development of the Gilpin county gold veins.

The mouth of the "great bore" has been located about two miles below Black Hawk, on the north branch of Clear Creek, some 7,000 feet above the sea, 1,800 feet above the plains, and nearly 1,200 feet below the level of Central City. Its course is a few degrees north of west, or in a direction that would intersect the Gregory, Fisk, Hunter and other lodes 15° to 20° from a perpendicular. The Bobtail, Mammoth, Winnebago, and other lodes of that system would be cut at a very acute angle.

From the mouth of the tunnel to the Bobtail lode, in a direct line, is 11,000 feet; and from that point on to the Gregory, about 800 more. The course being about 30° north of west, it will run under Central City, almost directly beneath Eureka street, and pass a short distance up that gulch, cut into Gunnell Hill, and pass through it into the main range.

The Bobtail is the first known lode of any prominence that will be intersected. This, as has been said, is 11,000 feet from the mouth, and will be struck about 1,300 feet from the surface. From this point on, the great bore will strike the Gregory, Bates or Hunter, Gunnel, Prize and Winnebago, in the order named. The three latter lodes are about 16,000 feet from the mouth, and will be opened nearly 2,000 feet from their surface outcroppings. Beyond these, if the tunnel ever reaches so far, it is not improbable that other valuable and large veins will be met with. The main divide between Central City and Middle Park is from 11,000 to 12,000 feet high in places rising to nearly 14,000 feet. In passing through this, the tunnel will reach its greatest depth, namely, from 5,000 to 7,000 feet.—*Mining Review.*

The Porpoise.

At the Brighton (Eng.) aquarium the keeper in charge of these interesting animals is now in the habit of summoning them to their meals by the call of a whistle; approaching footsteps, even, cause great excitement in their movements, and recent experiments have proved them to be acutely sensitive to the vibrations of sound. By the physiologist a more pleasing spectacle can scarcely be witnessed than the graceful action of these *cetacea* as they swiftly pursue their course up and down their spacious tank, ascending to the surface of the water at intervals of fifteen or twenty seconds to breathe, each inspiration being accompanied by a spasmodic sob-like sound, produced by the rush of air as a breath is rapidly liberated and inspired through the single central blowhole.

Onward progress is effected in these animals, as in all other *cetacea*, exclusively by the action of the horizontal caudal fin; the development of muscle at the "wrist" of the tail on which this action depends being enormous and plainly visible externally; the pectorals are devoted principally to the purpose of steering the creature to the right or left, aiding it also in rising to the surface of the water.

The fact alone of the porpoise suckling and evincing much maternal solicitude for the welfare of its young indicates the superiority of its position, in the zoölogical scale, above that of the other representatives of the finny tribe. A few dog fish, *acanthias* and *mustelus*, three or four feet long, placed in the same tank, soon fell victims to their tyranny, the porpoises seizing them by their tails and swimming off with and shaking them in a manner scarcely conducive to their comfort or dignified appearance, reminding the spectator of a large dog worrying a rat. The fine sturgeon, six feet long, now sharing an adjoining tank with the cod, was first placed with these animals, but in a short time was so persecuted that for safety it had to be removed; while to this day the lacerated condition of its tail bears witness to the pertinacious attention of its former comrades. Some large skate (*raja clavata* and *maculata*), while they maintained their usual habit of lying sluggishly on the floor of the tank, escaped molestation; but no sooner did these fish display any unwonted activity than the porpoises were upon them, and, making a convenient handle of their characteristic attenuated tails, worried them incessantly. It need scarcely be remarked that the skate were removed before further mischief could be done, leaving the porpoises, with the exception of a few conger (which during the daytime mostly lie hidden in the crevices of the rock work), turtles, and a huge monk fish (*rhina squatina*) sole occupants of the colossal tank.

While far behind the porpoises in display of intellect, the the representatives of the *gadidæ*, or cod family, are by no means the least intelligent of fish.—*Nature.*

Balloonaria.

The preparations for the transatlantic balloon voyage are now far advanced, and our enterprising contemporary, the *Daily Graphic*, tells us that an extra force of hands, working day and night, will hasten them to completion. It is believed that the great fabric will be ready for filling by the 30th of August, when it will start on the journey as soon as fully inflated. Besides the large boat suspended under the car, a smaller canoe will be carried, to serve as a life boat. This latter craft is fourteen feet long by twenty-eight inches broad, and is made of paper three eighths of an inch thick. It is a fine piece of workmanship, and is constructed with air chambers so as to be practically unsinkable. In event of the leakage from the balloon causing a descent and rendering it necessary to take to the water, Mr. Donaldson will attempt to reach land in the smaller vessel, while the rest of the party will navigate the larger boat. The above mentioned gentleman recently sailed the canoe on a trial trip between this city and Long Branch, making good time and arriving in perfect safety, although the sea was quite turbulent. The capabilities of the

CARRIER PIGEONS

are being thoroughly tested, and some of the birds have shown a wonderful speed. The Ariel, a pigeon that won the $2,000 prize in the international contest in Belgium in 1871, accomplished the distance between New York and Stratford, Conn., sixty-four miles, in thirty minutes. Another bird, known as No. 6, made the journey in almost as quick time. The pigeons are of the finest Belgian stock, and some two and a half years ago were imported by Mr. O. S. Hubbell. It is related that the flock, some two dozen birds in all, were imported in two detachments, and on their arrival were carefully confined for a long time in their cotes. After they had been thus mewed up, sufficiently long, as it was supposed, for them to forget all about their transatlantic home, the doors of the cages were opened; but to the dismay of their owner, who had invested upwards of a thousand dollars in them, every pigeon promptly flew away. In about four days, however, all returned, apparently very much exhausted and ravenously hungry, since which time none have ever attempted to leave their present abode. It is conjectured that the birds, on being released, made for the Atlantic coast and flew along its whole length, seeking to recognize some features of their Belgian birthplace. They have since multiplied very rapidly, and at the present time number about one thousand.

A number of these pigeons will be carried in the car of the balloon, and released at intervals with dispatches which they will carry, it is believed, directly to their cote at River-

© 1873 SCIENTIFIC AMERICAN, INC

cliff. As it is thrown from the balloon, each bird will probably fly wild until it sights land, to which it will immediately direct its course. The carrier pigeon has no peculiar instinct which directs him homeward, but seems to possess a memory for places, coupled with a very strong attachment for its abode. In its various excursions near the latter, it becomes acquainted with objects, say for a radius of seventy miles, so that, if once it sights any part of the circle, it can easily find its way home. On being let go, it first flies upward and perhaps looks over a circumference sufficiently large to include a portion of the circle above referred to, toward which it immediately travels. But in case it sights no known object, then it will fly in a chance direction for some distance, and then try again, and so on for about three times, when, if disappointed, it returns to its starting point and begins a new flight. A good bird will keep up this repetition until it discovers its home locality, or else it tries so often as to be discouraged; then it seeks a new home. The

HUMOROUS SIDE OF THE VOYAGE

seems to form staple exercise for the wits of the daily journals. Puns of various degrees of atrocity have been perpetrated on the name of Professor Wise, and the word "balloonatic" is so frequently used that it bids fair to become a part of the language. One journal suggests sending up an experimental balloon, with a car load of a selected party from the dozen or so emotionally insane murderers now in the Tombs in this city, and then, when at a sufficient elevation, spilling them out. Another exuberates to the effect that Wise's expedition cannot but be fruitful, because he is sure to find so many currents in the air. A third observes that, if flaming torpedoes are to be dropped along the course of the balloon, it might be well to provide the passengers of ocean steamers with cast iron umbrellas. Some of the alleged answers of correspondents to invitations, from the managers, to a seat in the car are quite amusing. One remarks that the voyagers are pretty sure to reach some locality, but whether in this or the other world is questionable; while another, poetically inclined, replies that:

"If I could read my title clear
To mansions in the skies,
I'd bid farewell to every fear
And with your gas arise."

Skillful Navigation in a Fog.

A correspondent to the Boston *Advertiser*, who writes from London, after completing his voyage across the Atlantic says: The Siberia, of the Cunard line, sailed from Boston, July 1, on the new southerly course for Liverpool, and striking into the fog on the first day out, did not meet with fifteen minutes' clear weather, when an observation could be taken, for almost eight days. But no pains were spared by the officers to make the dead reckoning accurate. The log was thrown every two hours day and night. On the evening of the eighth day, our latitude was estimated to be north 49°36′, but the fog was still dense enough for the fog whistle to be blown. A little later it lifted very suddenly, then the clouds broke, disclosing the pointers of the Dipper, and a moment later the North Star itself was visible. The chief officer hastened for his sextant, carefully took the altitude of the star, and found it to be 49°36′ to a second. And on the tenth day we came in sight of the Skillings, and bore up the coast of Ireland to the Fastnett Light without changing the course a fraction of a point. And this was the first time the Siberia had sailed upon the new course, and during three fourths of the time she had been enveloped in fog.

DECISIONS OF THE COURTS.

United States Circuit Court.---District of Massachusetts.

PATENT HAND STAMP.—THOMAS J. W. ROBERTSON *vs.* BENJAMIN B. HILL.

This was a motion for a preliminary injunction in a suit founded on the patent of Thomas J. W. Robertson for an improvement in hand stamps, dated September 22, 1857, extended and reissued December 12, 1871. The patent had been previously sustained in several suits. (*Robertson* vs. *Secombe Manufacturing Co.*, 3 OFF. GAZ., and others.) The motion was resisted on the ground that the invention was anticipated by a large number of English and French patents, and because the invention, as patented, was lacking in utility from the absence of any suitable device for coloring the face and type of the stamp.

SHEPLEY, *J.*:

This is a motion for a preliminary injunction. In this case the patent has frequently been made the subject of legal investigation.

The validity of the patent has been established and confirmed in at least three cases, and under such circumstances, on a motion for a preliminary injunction, the Court very seldom hears any evidence except on the question of infringement. Under such circumstances the party, by the established rules of equity, is entitled, as a matter of course, to the preliminary injunction without a trial at law and without further trial of the cause, especially in a case like this, where the party defendent in the cause was interested in the defense of the suit and had full opportunity to test the question.

Ordinarily, therefore, in such a case, the Court, on a motion for a preliminary injunction, considers only the question of infringement, and that is the established rule of the court.

In this case, however, the Court has considered, with as much care as the time would allow, one question which has been raised by the counsel for the defendant, and which may properly be considered under the question of infringement. It is contended by the defendant that, when a party has patented a combination, and that combination turns out to be useless, of no practical utility, and another party adds to that combination another element, and thereby makes the whole practically useful where there was no utility before, the party who thus adds another element to the combination, which was necessary to make the prior combination of any practical utility, is not an infringer, and that he is not entitled merely to use his improvements, requiring first a license to use the former combination, but that he may use the whole of it; and that view of the law is undoubtedly correct.

In that view of the law it is contended that there is no infringement in this case, and it is with a view to question of infringement only that the court has considered it, not deeming it necessary to go into any consideration of the question of novelty, or entertain or express any opinion on that question until the final hearing of the cause.

But considering that the right of the party depends upon the validity of the patent and the fact that that question has been adjudicated so many times, it is not the intention of the Court, in any case, upon a motion for a preliminary injunction, to express any further opinion upon the questions involved in the case, except such as are absolutely necessary to the decision of the question of infringement on the motion for a preliminary injunction.

But on an examination of the patent, the Court, while it believes that view of the law to be correct, cannot conceive it to be applicable to the present case.

It is contended by the defendant in this case that the combination of the plaintiff, which was the combination of a handle and a series of printing-wheels, or their equivalents, for printing dates with a fixed type form or printing die for dating purposes, substantially as described, had no practical utility, because without the inking ribbon or device which the defendant has added, it was of no practical use; that the wheels would clog by the ink; and it was of no practical use, and did not come into use, until the ribbon as an inking device was added to it by the defendant.

But it does not appear that Robertson, the patentee, here, has stated in his patent any combination with any inking device, but has stated that his combination could be used with any suitable inking device.

An inking device formed no part of his combination, but it could be used, he says, with any suitable inking device. Now, the testimony in the case shows very clearly that the ribbon was an inking device which was known prior to the date of this patent—was known and in use and described in patents prior to the date of this patent. It was, therefore, one of the inking devices which the complainant had a right to use, and which he is to be considered, in the eye of the law, as having referred to as a suitable inking device in his patent.

Therefore, although it should be proved to be true, that if the plaintiff's combination were used with a common inking pad, or by applying printers' ink with rollers in the usual way, it would so clog and interfere with the turning of the wheels that it would not be a practically useful device, still he was open to use the ribbon as a roller, which had been known and used as an inking device prior to the date of the patent.

The conclusion of the Court, therefore, is that, under the present state of the proof, in view of the prior decisions in the case, the injunction must go, as prayed for.

[*Frederick H. Betts*, for complainant.
James B. Robb, for defendant.]

NEW BOOKS AND PUBLICATIONS.

STEAM AND THE STEAM ENGINE, LAND, MARINE, AND LOCOMOTIVE. By Henry Evers, LL.D. Author of "Navigation," "Nautical Astronomy," etc., and Professor of Mathematics and Applied Science at the Charles Science School, Plymouth, England. Price $1.50. New York: G. P. Putnam's Sons, Fourth Avenue and 23d street.

An excellent practical treatise, by an undoubted authority. The work is made available for purposes of instruction by the addition of some varied and exhaustive questions, to be answered by the student. The book is No. 22 in Messrs. Putnam's "Advanced Science Series."

PRACTICAL CHEMISTRY: for use in Science Classes and Higher and Middle Class Schools. By J. Howard, Head Master of the School of Science and Art, Islington, England. Price 75 cents. New York: G. P. Putnam's Sons, Fourth Avenue and 23rd street.

An elementary book of the highest class; lucid in its descriptions and steadily progressive. The writer is evidently a teacher of ability.

STEAM BOILER EXPLOSIONS, By Zerah Colburn. No. 2 of Van Nostrand's "Science Series." Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren street.

Voluminous as the literature on this subject has become, there is still room for practical information; and such sound wisdom, drawn from actual experience, as the late Mr. Colburn possessed can never be out of date. We commend this little book to all our correspondents who write to ask questions on, or to report, explosions of steam boilers.

A GRAND VICTORY OVER EVERY COMPETITOR IN THE WORLD.

The following Cable Dispatch from Vienna will convey the glad intelligence to the world that the "World Renowned WILSON Sewing Machine" has not only taken all of the highest Awards at Fairs and Expositions in the United States, but that it has overwhelmingly defeated every Sewing Machine manufactured in the World, and carried off the first Grand Prize at the Vienna Exposition:

VIENNA, Austria, Aug. 15, 1873.

To W. G. WILSON, President Wilson Sewing Machine Company, Cleveland, Ohio:

"The Wilson Shuttle Sewing Machine was awarded the Grand Prize at the Vienna Exposition for being the *best Sewing Machine*." RAYNOR.

Advt.

Recent American and Foreign Patents.

Improved Hopper for Grinding Mills.

Martin Replogle, Moulton, Iowa.—For automatically closing one spout, and opening the other, of a double or two part stock hopper of grist mills, it is proposed to have a right angled valve arranged between two disks, and pivoted at the angle under the middle partition between the two spouts, so that by a quarter of a revolution on the axis one spout will be closed and the other opened. The side which is open will be subject to considerably more pressure by the grain passing through than the one which is closed by the grain in the hopper above, so that it cannot shift until the hopper from which the grain is running is empty, when the weight of the grain in the other hopper will instantly open it by the weight on the side closing the spout. A bell is attached to the axle of the valve, so as to sound each time the valve shifts and changes the grists to notify the miller of the change.

Improved Reel.

Robert Simon, Paterson, N. J.—This invention consists in a reel, the arms of which are provided with dividing disks for separating the two parts of the skein, so that the silk or thread wound on such reel may be crossed in opposite directions in the spaces between alternate pairs of arms, in order that at such crossing each separate strand will be above its predecessor.

Improved Apple Parer.

William A. C. Oaks, Reading, Pa.—This invention has for its object to so improve the apple parer patented to the same inventor on December 10, 1872, that the knife will make a positive stop until the apple has made one revolution. The invention consists in providing the gear wheel of the knife arm, at that point at which the knife takes its position for paring the apple, with two or more recessed cogs and a projecting tooth and lug extension, in connection with the pinion wheel of the crank shaft, having also part of the teeth cut off and provided with a circular flange, so that thereby a full stop of the paring knife is obtained while the fork is revolving once with the apple.

Improved Shoemaker's Pinchers.

William H. Hanna, Chico, Cal.—This invention consists of a pair of shoemaker's pinchers, having the jaws in the same longitudinal plane and the teeth abutting against the turning face of the jaws, so as to bring the bite near to the pivot, and thereby not only to secure more leverage in the gripe, but thus to enable the upper to be drawn close to the last.

Improved Clothes Pounder.

Edward S. Saxton, Greenfield, Ill.—This invention is an improvement upon the clothes pounder for which letters patent were issued to Ezra Pollard, December 28, 1858, and consists in a wooden block provided with a central vertical hole and with two circular concentric rows of holes, between which a circular communicating groove is formed to allow the air to enter and escape from the inner row of holes through openings in the outer row or in the side of the block.

Improved Parallel Ruler.

Gustav Blunck, New York city.—This invention consists in a main slide piece, with suitable set screws, moving in a guide frame carrying the adjustable ruler, and acted upon by a band spring applied to a wedge-like thumb-piece, which produces alternately, by the pressing and releasing of the controlling finger the required parallel motion of the ruler.

Improved Stop Valve.

George W. Eddy, Waterford, N. Y.—This invention relates to that class of stop valves for water, steam, gas, etc., in which one or two disks or gates are arranged in a chamber traversing the water way, and work transversely across the water way on the seat or seats, and are pressed thereon to close the water passage by means of the valve stem; and it consists of levers combined with the disks or gates and an enlargement on the valve stem in such manner that, when, in closing, the gates have returned to their seats, the levers and the enlargement come into play in such manner that they force the gates upon their seats with a powerful lever pressure, which is produced with the stem by the operator without much effort.

Improved Truss Bridge.

Henry J. Hunter and Jesse Rice, Scioto, Ohio.—It is proposed to have bottom, middle, and top chords composed of three parallel timbers, with double posts framed or boxed between the timbers of the bottom and top chords, and passing between the timbers of the middle chord without boxing, and with braces firmly secured to the posts and the bottom chord, all in a manner calculated to produce very strong frames, capable of sustaining great weight in long spans.

Improved Pile Driver.

Charles H. Smith, Bloomer, Wis.—This improvement in pile drivers consists of an endless chain for raising the drop, working over a driving wheel at the bottom and a drum at the top of the frame, and through contrivances on the drop, with which a lock and a trip are arranged, so that a weight causes the lock to engage the chain when the drop strikes, so that the chain immediately lifts the drop again, and thus saves the time lost in the ordinary pile drivers in running the hooks down to connect with it. The lock is tripped at the top of the frame, or at any desired intermediate point, by an arm coming against any suitable stop in the ascent of the drop. The invention also consists of a crane and hoisting rope combined with the driver and the driving mechanism in a simple manner, for raising a pile while another is being driven by the same driving gear by which the drop is worked. It also consists of a guide for controlling the head of the pile while being driven, contrived so as to be engaged with the rib guides, on which the drop works, after being attached to the head of the pile before it is raised up to be fixed in the machine.

Improved Cradles.

Franklin Chichester, Milwaukee, Wis.—The first invention consists in two-part cradle ends, set apart and connected by intermediate springs. These springs, one at each end, raise the extension and body from the base, which allows the cradle or crib to rock back and forth on the springs, the rocking motion being limited to the width of the openings between the extension and the base. The same inventor has also patented another cradle in which there is a central pivot at each end. A flat spring at each extremity is attached at its ends to the iron rail of the body.

Improved Treadle for Sewing Machines.

William D. Wood, Mount Sterling, Ohio, assignor to himself and John Clarridge, of same place.—This invention consists of a pawl and lever and a bell crank combined with the treadle mechanism of a sewing machine, in such manner that the operator can start the machine by a lateral movement of one of the knees, and thus save the labor of starting the wheel by hand. The invention also consists of a holding pawl combined with the balance wheel and a double crank, the object being to prevent the machine from being turned backward, to which a double crank is liable without a holding pawl.

Improved Washing Machine.

Josiah Glines, Postville, Iowa.—A board set on edge is designed to keep the clothes upon the opposite sides of the machine separate from each other. An upper roller is fluted longitudinally, and revolves in uprights. To it is attached the crank by means of which the machine is operated. The lower roller is also fluted and slides up and down in slots in the lower part of the uprights. To the lower ends of the sliding bearings and to the upper edge of the ends of the division board are attached pins to which are secured the ends of the U shaped springs, by which the lower roller is held up against the upper one so as to apply pressure to the clothes while passing through the machine. Four rollers at the inner corners of the uprights diminish the friction as the clothes are passing into and out of the machine.

Improved Saw.

Sylvester Cook, Alpena, Mich.—It is proposed to divide the teeth of a cross cut saw into groups of four teeth by a wide blank space of about one inch between, and in each group to have two teeth fronting one way and two the other, with their cutting edges formed at right angles to the longitudinal axis of the saw. The ends of the teeth are beveled enough for clearance, and the cutting edges and ends shaped like a chisel edge by beveling them on one side only. The beveled sides are alternately reversed. At the heel of each rear tooth of a pair is a cleaner, for scraping out the chips cut off by the teeth, said cleaner being an extension of the heel of the tooth as low as the point.

Improved Roller Clearer for Spinning Machines.

Charles B. Brown, Lewiston, Maine, assignor to himself and Alvin Woodman, of same place.—This invention pertains to an improvement in the construction of clearer rolls of spinning frames; and it consists in providing a covered roll with an enlargement, or, in other words, in reducing its diameter uniformly at every point except the center. Thus constructed, only the enlarged portion will come in actual contact with the rolls of the spinning frames.

Improved Metal Planing Machine.

Robert Harper, Glenn Mills, Pa.—This invention has for its object to furnish an improved machine for cutting key seats in shafts without removing said shafts from their bearings. Two screws are swiveled in bearings attached to the four corners of the bed. To one end of the screws are attached bevel gear wheels which engage with similar devices on a cross shaft to which power is suitably applied. The screws also pass through screw holes in a cross head that slides upon ways which are so formed as to cause the said head to move back and forth squarely, and to sustain the upward pressure of the tool, thus relieving the screws from any strain. To the crosshead is attached a block, the upper and lower sides of which are beveled to form a way for another block. The side edges of the second block are beveled to serve as a way for a third block, on the forward side of which is a T groove formed to receive the tool holder, through a slot in the forward end of which the shank of the tool is passed. By this construction, the tool can be adjusted vertically and horizontally, and inclined to one or the other side, as may be required. Four set screws pass in horizontally through the side bars of the bed to receive and hold the work to be planed or dressed.

Improved Propelling Vessel.

George W. Dow, Brooklyn, N. Y.—This invention consists in the improvement of that class of boats which use suction wheels in the side of boat, drawing the water in from the side and discharging it at stern or bow, according to whether it is desired to go forward or backward. It consists in the peculiar means for enabling the boat to be backed, by means of a gate closing the channel through which the water is drawn to the rear, and opening a reverse channel through which the current is forced.

Improved Sash Holder.

George W. Richardson, Columbus, Ky.—The object of this invention is to furnish means for holding the sashes of windows in any desired position in the frame or casing; and it consists in the arrangement of a spiral or coil spring, acting upon the sector or wedge-shaped rack. By a slight upward pressure on the operating lever, the sector is turned and the wedge is moved downward and the sash released.

Improved Kerosene Heater.

Ziba B. Grandy and Cyrus E. Grandy, Stafford Springs, Conn., assignors to themselves and William D. Heald, of same place.—The object of this invention is to furnish improved facilities for heating water and other liquids by means of a kerosene lamp; and it consists in two annular liquid reservoirs arranged around the lamp chimney. Two different kinds of liquids—as water and milk, for instance—may be heated at the same time The heater is made of tin or similar material, and the chimney is riveted or soldered with hard solder so as to resist the effects of the heat.

Improved Ladies' Gaiter Shoe.

Henry C. Letsinger, New York city, assignor to Edwin C. Burt, of same place.—This invention has for its object to improve the construction of ladies' gaiters, so that there will be no seam crossing the instep; and it consists in having the vamp made in one piece with one of the half-quarters, and seamed to the other half quarter, the seam commencing at the junction of the overlapping parts, and terminating in the shank between the heel and sole.

Improved Car Coupling.

Daniel C. Camerer, Martinsburg, Pa.—This invention consists in the improvement of car couplings by combining the buffer spring with a rigid buffer bottom, having an upright plate and a sliding box, having partitions, to support the link in a new and convenient manner.

Improved Life Preserving Attachment for Railroad Cars.

John C. Wands, Nashville, Tenn.—This invention aims to protect brakemen on railroad cars, and consists in a foot piece and rail raised on a bracket applied to the top of cars, so that the brakesmen can pass from one car to another without damage to life or limb.

© 1873 SCIENTIFIC AMERICAN, INC

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Parties offering inducements for location of a manufactory of Hardware employing forty hands, also those having a small factory for sale cheap, address with full particulars, Box 3131, New York P. O.

Situation Wanted by a practical Machinist and Mechanical Engineer as Foreman in a Machine Shop or inventor in a Manufacturing Establishment where inventive genius is required. Address Foreman, Box 957, Dayton, Ohio.

Edson's "Time and Pressure" "Recording Gauges" are indispensable when testing boilers, etc., as automatic data only are perfectly reliable. See Adv.

For Sale.—A New Stover Dimension Planer 24 in. x 12 ft. For circular and price address D. S. & B. Co., Box 1243, Columbus, O.

Steam and Water Packing Manufactured by The Manhattan Packing M'f'g Co., 15 Frankfort St., N. Y. This Packing is superior to any in the Market.

Buy Boult's Pat. Molding and Dovetailing Machine, for all kinds edge and surface molding. Battle Creek Machinery Company, Battle Creek, Mich.

For 2, 4, 6 & 8 H. P. Engines, Address Twiss Bros., New Haven, Conn.

Nobody will buy the metal Truss with its pitiless Iron Finger. The New Elastic Truss, 683 Broadway, New York, holds the rupture easy till cured. Pressure all around the body.

For $1 I will send: How to draw with compasses. Scrolls as quick as circles. Address Box 91, Ripley, O.

Best Steam Fire Engine or Hook & Ladder Signal Lamps. Apply to White M'f'g Co., Bridgeport, Ct.

A Condensed Treatise on Silicate or Soluble Glass just published and mailed free on receipt of $1. L. & J. W. Feuchtwanger, 55 Cedar street, N. Y.

Chemicals of all kinds for all trades made to order at our own Laboratory by addressing L. & J. W. Feuchtwanger, Chemists, 55 Cedar street, N. Y.

Master Car Builder wanted immediately. None need apply unless fully qualified and furnishing best of references. Herrick's Car Works, Oswego, N. Y.

Valuable recipes in every branch of Industry, in the world, furnished by Jas. S. Burch & Co., Franklin, Tenn.

A Machinist and a Moulder with a small capital can form a partnership to a good advantage. Address Letter Box 252, Knoxville, Tenn.

For Sale—A valuable improvement in Cylinder planers. Dresses lumber out of wind, one or more sides, while once passing through at rate of ordinary surfacing. Working model in operation. Address Jno. E. Heath, Albany, N. Y.

Wanted.—A machine to take burs out of wool. J. M. Ferguson, 162 Front st., New Orleans, La.

For Inventions or Improvements to facilitate your manufacturing and labor, address S. E. Harthan, Worcester, Mass.

Wanted.—A competent man to take charge of enameling department in Card Factory. Apply to Paper Fabrique Co., Cincinnati, O.

The Olmsted Oiler is the best; it is self-righting, strong and cheap. All Hardware and Tin Houses have it.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Inventors who desire to have their inventions and patents introduced and represented in Europe by a gentleman of experience and integrity, should address K., Box 2979, New York Post Office.

For Sale—New Patent for Refrigerator and Beer Cooler, etc., combined. Enquire of or address G. Nuss, 55 1st Avenue, New York City.

Key Seat Cutting Machine. T.R.Bailey & Vail.

Portable Hoisting and Pumping Engines—Ames Portable Engines—Saw Mills, Edgers, Burr Mills, Climax Turbine, Vertical and Horizontal Engines and Boilers; all with valuable improvements. Hampson, Whitehill & Co., Newburgh Steam Engine Works, Depot 38 Cortlandt Street, New York.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

Scale in Steam Boilers—How to Remove and Prevent it. Address Geo. W. Lord, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with rubber Tires. Address D. D. Williamson, 32 Broadway, New York, or Box 1809.

Inventors or parties having specialties for sale, which they would like introduced and represented in cities of Pittsburgh and Allegheny, address O. W. Runyan, Box 598, Pittsburgh, Pa.

Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracute, Bridgeton, N.J.

For best Presses, Dies and Fruit Can Tools Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N.Y.

Buy Gear's Wonderful Paneling Machine, Boston, Mass.

Fine Machinery Oils.—We take pleasure in calling attention of our Manufacturing readers to E. H. Kellogg's advertisement in another column, and saying that we believe his claims in regard to fine Engine, Spindle, and Signal Oils are fully justified by the facts, and that parties who try his goods will not have cause to regret it.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mf'g Co., 30 Cortlandt St., N.Y.

Stave & Shingle Machinery. T.R.Bailey & Vail.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Bookkeepers should try the Olmsted Patent Bill File and Letter Clip. They are admirable for all papers. Save their cost in one day's business. Sold by all Stationers. J.H. White, Newark, N.J., Sole Manufacturer.

To sufferers from batteries that get out of order on Burglar Alarms, etc., the Leclanche Battery Co., 40 West 18th st., New York, guarantee these batteries to last one year without any attention.

Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail, Lockport, N. Y

For Sale—3 Pat's at less than half their value, two for Impr'ts in advertising Lanterns, one for Impr'ts in Envelopes, by S. Kuh, Jefferson, Iowa.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, Page 389. Circulars free. J. W. Sutton, 95 Liberty St., N.Y.

Catalogue on Transmission of Power by Wire Rope. T. R. Bailey & Vail.

Bolt Makers, send for descriptive cuts of Abbe's Bolt Machine, to S. C. Forsaith & Co., Manchester, N. H.

Mills for Flour, Feed, Paint, Ink, Drugs, Spices and all other purposes. Ross Bros., Williamsburgh, N.Y.

Nickel and its Uses for Plating, with general description. Price 50c. a copy, mailed free, by L. & J. W. Feuchtwanger, 55 Cedar St., New York.

Silicate of Soda and Potash—All grades, in liquid, jelly, and dry state, for sale in quantities to suit, by L. & J. W. Feuchtwanger, 55 Cedar St., New York.

Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Rutland, Vt.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable, W. D. Andrews & Bro. 414 Water st. N. Y.

The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

Damper Regulators and Gage Cocks—For the best, address Murrill & Keizer, Baltimore, Md.

Steam Fire Engines, R.J. Gould, Newark, N.J.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Gear's Machinery Depot is the largest known. Boston Mass.

Cabinet Makers' Machinery. T.R.Bailey & Vail.

Notes & Queries

R. B. says: A certain length of railroad track has a siding which is just long enough to allow a train to pass on the main line, when the siding has on it eight cars and a locomotive. Suppose two trains, each containing sixteen cars and a locomotive, and moving in opposite directions, meet at the siding; how can they pass each other?

J. C. L. asks: 1. Will a powerful light of any kind, 8 feet under water, illuminate an object in the water so that it can be seen at a distance of 30 or 40 feet? 2. What kind of light is best for that purpose and how can I make it? 3. Can that light be seen from a small boat or ship 50 or 100 yards away?

C. L. asks: How can I prepare a wheel for grinding the carbon diamonds for turning or working hard metal?

A. E. G. asks: How can I prepare sizing for a plastered wall to be applied before kalsomining?

H. H. says: I have a cast iron house furnace that leaks gas. What is the best recipe for cement to prevent it?

D. J. W. asks: What is the quickest and best way to dress a deer skin, so as to make good buckskin?

C. asks: Is there any cheap metal or alloy that will resist the action of tomato acids? Tin and copper plate are acted upon and destroyed in a very short time.

R. F. H. asks: Is there a process by which I can combine wax with water?

Answers to Correspondents

O. G. will find a review of a book on expression on p. 248, vol. 28.—G. B. D. will find directions for a nickel solution on p. 187, vol. 28. Wet your litmus paper with the liquid you wish to test, and watch the change of color, if any.—J. W. McC. is informed that there are no reliable statistics published on the subject.—A. E. G. will find directions for kalsomining on p. 351, vol. 24.—R. F. H. will find a recipe for waterproof leather cement on p. 119, vol. 28.—H. P. will find the rule for calculating horse power on p. 123, vol. 29.

M. M. B. says: I have long known that the compression of air and other gases is attended with an increase of temperature, but how much, I have been unable, from the books and papers that I have had access to, to ascertain. Can you give a table of the increase of temperature by compression? Answer: The following table of heat developed by compression of air and fixed gases is by Professor Thurston, of the Stevens Institute of Technology, Hoboken, N. J. The volumes are expressed in cubic feet.

Pressure in lbs. above atmosphere.	Temperature measured from zero Fahr.	Volumes cubic feet under temperatures. Variable	Constant—60° Fahr.
0	63·1°	98·6	98
5	108·7	80·4	73·5
10	146·8	68·6	58·8
15	179·8	60·3	49·
20	209·1	54·0	42·
30	259·8	45·2	32·7
40	303·0	39·2	26·7
50	340·9	34·8	22·6
60	374·9	31·4	19·6
70	405·8	28·8	17·3
80	434·2	26·6	15·3
90	460·6	24·8	14·
100	485·2	23·2	12·8

C. M. Mfg. Co. ask what phosphor-bronze is made of, and whether it is capable of being worked readily by the ordinary machinists' tools. Answer: It is made by adding a very small per centage of phosphorus to gun metal (copper and tin) which contains ten per cent of tin. We believe it is capable of being easily worked. It might not be difficult for you to make up a small sample and try it.

H. F. R. says: On page 60, current volume, in answer to B., you state the weight of broken anthracite coal of almost any size to be 38·5 cubic feet per tun. Have these figures been verified? I find that a coal firm, in whom I have had great confidence, have succeeded in stowing ten tuns of Lehigh furnace coal into a space of 333 cubic feet, or 33·3 feet per tun. Also seven tuns of Lehigh stove coal into a space of 247 cubic feet, or 35·3 per tun. Answer: The figures we gave were average ones, from a variety of results. Should we get a sufficient number of communications, containing the results of actual practice, we may be able to give a closer approximation.

R. H. M. asks what effect turning has in the manufacture of ice cream. Does the centrifugal force, combined with the low temperature, help to freeze it, or is it like the churning of cream to bring butter? Answer: The object of turning or stirring the cream to be frozen in the freezer is to bring all the particles of fluid cream successively in contact with the cold sides of the freezer, in order to make a uniformly frozen mixture. Centrifugal motion has nothing to do with it. If the cream in the freezer were not stirred, it would freeze hard only around the sides of the freezer, and as ice is a very poor conductor of heat, the center of the canful would remain fluid for a long time. That frozen around the sides, too, would be miserable watery stuff compared with that in the center, as it is well known that water, if undisturbed, is apt to freeze more or less free from foreign mixtures. By constant stirring and agitation, however, a uniform frozen cream is produced, and the freezing is effected in a shorter time.

J. H. B. asks: Is there any ingredient known that will prevent sugar sirup from crystalizing? Answer: We cannot recommend any chemical ingredient to prevent sirup from crystallizing. You can attain the object to a certain extent, by heating in open vessels to as high a degree as possible without charring.

T. H. H. asks: What is good to stop a boiler from foaming? I have a 5 horse power one which foams very badly. The boiler is 6 feet high and 2½ feet in diameter; it holds about 75 gallons of water. The water surface takes up about 4 feet 9 inches, and I have only 15 inches steam room. There are 36 one inch tubes in the boiler. The water used is clean. Have I too much water and not steam room enough? I blow the water out about once every two weeks. Answer: Probably in your case the steam room is too small. If you can safely maintain a higher pressure of steam, you will be able to partially close the throttle valve, which may check the foaming.

W. P. H. says: I would like to have your mature judgment as to the correctness of two statements made in your invaluable journal. The first is under the caption "Hot Air Furnaces," dated March 15, 1873. The second is contained in your last issue, August 16, 1873, under the caption, "The Permeability of Cast and Rolled Iron to Gases." If gases do pass through cast iron, as stated in the first, at what temperature? And if not, as stated in the second, will you please give me some light on the matter? Answer: Such action (the passage of hydrogen and carbonic oxide through iron) does not occur at the temperature to which the metal is subjected in ordinary furnaces, but only at temperatures nearly high enough to melt the metal.

F. D. P. says: I have a 7 x 18 engine, running at 100 revolutions per minute, and a boiler 18 feet x 36 inches, with two 14 inch flues. The feed pump is directly above the piston and is opened by a connection between the piston and pump rods, thus running 100 per minute. Running at this rate, it will not supply the boiler; but, by partially closing the throttle valve and allowing the engine to run slowly, it will fill the boiler very quickly. Now we wish to speed up our engine, but are afraid the pump will work worse. Can you tell us the cause, and how to remedy it? The pump cannot be separated from the engine. Answer: We suppose that the pump runs away from the water, the supply pipe or suction valve being too small. Probably the valve is large enough, and the supply pipe too small, in which case you can easily remedy the trouble. It might be worth your while to consult some good engineer, as, with the data you have sent, it is impossible to give anything but a hypothetical reply.

W. G. asks: 1. Is there any mode by which a common scholar can find the heating surface of a boiler? If so, how is it done? 2. How can I get the size of a smoke stack for a boiler? What is the rule for calculating the area of a number of small flues? Having found the area, do you allow the stack the same, or do you allow it less or more? 3. How big would you make a boiler for a 10, 15 or 20 horse power engine, and how many pounds of steam is one horse power? 4. Which is the easiest way to find out how many barrels a tank holds? 5. Which is the best book for a boiler maker, giving information on one or all of these points? Answers: 1. For flat rectangular surfaces, multiply the length in feet by the breadth in feet. For irregular flat surfaces, we must refer you to rules given in every pocket book for engineers. For cylindrical surfaces, multiply the diameter by the length, and by the number 3·1416; add all the areas together. 2. See answer to L. P. C., in Scientific American for May 24, 1873. 3. Makers allow from 12 to 15 square feet of heating surface per horse power, and half a cubic foot of water evaporated per hour is quite a common allowance for a horse power. 4. Calculate the contents of the tank in gallons or cubic feet, also the contents of the barrel, then divide the first by the second. 5. Haswell's "Mensuration," Haswell's "Engineer's Pocket Book," and Blinn's "Sheet Iron Worker," will be useful books for you to have. For a single work, containing a very complete collection of rules and formulas, we can recommend Trautwine's "Engineer's Pocket Book."

P. I. says: I live in the neighborhood of two blast furnaces for manufacturing pig iron, and I would like to fit myself to fill some position of that business. Can you tell me what is the best course to pursue, and what books I should study to learn the same? Answer: We can recommend Overman's "Metallurgy." and Schurz's "Researches on the Action of the Blast Furnace."

T. L. B. says: I am building a small oscillating engine, 2 inches bore x 3 inches stroke. Would a boiler 1 foot in diameter and 1 foot in length, with 4 one or one and a half inch flues, be large enough to supply the engine with steam? Would an engine and boiler of these dimensions be large enough to run a boat 16 feet in length? What arrangement could I use to force water into the boiler while under a pressure of steam? Answer: The boiler would be much too small. The boat would be propelled very slowly by such an engine. The boiler could be fed by the direct pressure of the steam, using an arrangement like an equilibrium oil cup.

J. B. D. asks: 1. Can racks be cut in solid wrought iron bars, ¾ x 3 x 12 inches, by a milling cylinder 15 inches long x 1½ inches diameter, so that a plain smooth margin, ½ an inch wide, may be left on each side of the track? 2. Do the patent authorities in foreign countries reject their citizens' applications, if the inventions are known to have been patented or described in a printed publication? 3. Why does lightning sometimes ignite green trees, buildings, etc., and at other times, strikes dry wood and not ignite it? Answers: 1. We think you could cut the racks by the plan proposed, if the machinery were accurately made. The flutes in the milling cylinder should be spiral. 2. In most foreign countries, if the publication of a patent from abroad had reached that country, the application will be rejected. 3. It is probably impossible to explain the reasons for the strange freaks of lightning.

E. asks: What proportion of tungsten would be required to toughen 100 lbs. of German silver Would it also tend to whiten the German silver? Answer: Tungsten, when combined with iron or steel, not only forms a tough alloy, but one that becomes more and more infusible as the proportion of tungsten increases. Other alloys that contain more than 10 per cent, of tungsten cannot be melted into a homogeneous fluid mass, and where a volatile metal like zinc is used (as in German silver) it would be volatilized before the alloy could be fused. Copper, zinc and nickel, the ingredients of German silver, will only unite with tungsten when all the metals are reduced from their oxides together. Metallic tungsten is infusible in the strongest forge fire, requiring 200 pairs of Bunsen cells to melt it.

O. C. says: I am told that John Fitch was the inventor of steam, or first applied steam to navigation. If this be so, what had Watt, Fulton and Stevens to do with it? Answer: Watt's improvements were confined to the engine itself, making it available for all purposes. Fitch, Fulton and Stevens experimented in adapting steam engines to the work of revolving paddle wheels.

A. P. asks: 1. What is meant by ebonite? Is it the same as ebony? 2. Must the upper disk of Carré's electrical machine be just one sixteenth of an inch thick? 3. How much would a patent cost for the improvement of the plow? Answers: 1. Ebonite is hard vulcanized rubber. 2. Yes. 3. $61 in full, if simple.

T. F. H. says, in reply to R. K., who asked how to make tight joints in engine cylinders: Two engines, made by different makers and of different patterns, have been closely observed by the writer. The first was made useless by this eating away of the iron, as described by R. K., so that it could be cut like plumbago after being used about 5 years. In that time it wore out two sets of steam chest covers or bonnets, and the studs were pulled out of the cast iron so that larger ones had to be fitted in their places. The covers were first packed with rubber; as soon as the softening of the iron was observed, the rubber was replaced with canvas and red lead, still the eating away grew worse. Tallow was the lubricator then. After awhile it was found necessary to have the surfaces of the joints refaced, and the joint was made with white and red lead alone, and suet, fresh and sweet, was used as the lubricator. Still the destruction went on; lard oil, paraffin, and sperm oil have all been tried, but there was no help, and the conclusion was that the iron was poor somehow. That engine was replaced about two years ago by another of a superior make. This one has steam valves on one side of the cylinder, and independent exhaust valves on the other side. There is a cover over each valve, and the joint is made iron to iron, the surfaces being nicely fitted by scraping. This engine will be used up precisely like the former. There is nothing unusual in the boilers or their connections with the engine. The exhaust is conveyed into a cast iron heater with brass tubes, and several engineers and experts say that is where the mischief comes from. But if so, why does not the exhaust side of the cylinder waste away like the steam side? On the contrary, nothing of the kind can be found there, the iron being hard and sound. With the former engine, the boiler used was rather too small for the power required; and being forced, the steam was sometimes rather wet. Boilers of ample capacity supplying the driest steam are now in use. Something in the water was thought of, and the water was analyzed by Dr. Nichols, of Boston; the result shows that no reasonable fault can be found with the water for steam purposes.

W. Y. C. asks: 1. Why should cyanide of potassium when mixed with pure rain water to form a saturated solution, begin to turn brown after remaining clear for three days, deposit a brown sediment and gradually grow darker until perfectly opaque, the temperature being from 80° to 60°? The solution is kept in a glass stoppered bottle. 2. In removing stains from white garments, which is the best form in which to apply chlorine? 3. What is verdigris; why and how does it form, and why does it form most readily where candles are being burnt? 4. What is the best way to make solutions and test papers of litmus and turmeric, and must they be boiled with water or not? 5. Will perchloride of tin turn to the protochloride of tin on introducing pieces of block tin? 6. Is it true of any polygon (regular or irregular) that twice the number of its sides minus 4 is equal to the number of right angles contained in the sum of the interior angles of that polygon, whether there be re-entering angles or not? Answers: 1. It may be owing to some impurity in the water, or if not, to some decomposition of the cyanide. 2. A solution of bleaching powder (chloride of lime.) 3. Verdigris is a basic acetate of copper made in Southern Europe by the action of refuse pressed grapes on sheets of copper. It forms by the action or affinity of acetic acid on or for copper. The only action that burning candles could have would be to heat the materials and hasten the chemical change. 4. Boil your litmus or turmeric in water; and when a strong decoction is made, soak blotting paper in them and dry. 5. No. 6. Yes.

A. D. N. asks, in reference to our reply to Y. E., page 92 of our current volume: Supposing Y. E. were to connect a similar engine to the other end of shaft, set ¼ revolution ahead, how would it increase the strain upon the shaft? Is not the strain upon an engine shaft variable from nothing at the dead centers to the maximum when the cross head is at the center of the guides? Would not, therefore, the addition of another engine merely make this maximum strain continuous and uniform? Answer: Suppose, in the case of one twelve horse power engine, the shaft were just strong enough to transmit this power, and would break if more strain were put upon it. Now, attaching another engine of 12 horse power, the shaft would have to transmit more, and would evidently break. To those who understand algebra and elementary mechanics, the matter can be explained in another way. Let P=pressure on crank pin, and a=radius of crank. Then for one engine, the maximum moment of strain on the shaft=P×a. Adding another engine of the same size, with its crank set at an angle of 90° to the first, we find the maximum moment of strain $=P\times a\times\sqrt{2}=P\times a\times 1{\cdot}8284$, which is 1·8284 times as great as the maximum moment in the first case.

R. V. E. asks: 1. What causes the attraction of the needle of a surveyor's compass? 2. Where is that attraction situated? 3. How great is the variation of needle of compass, and (4) in what time will it return to true course? 5. What is the title of the best work on these questions? Answers: 1. The earth is a great magnet, causing the needle to lie in the magnetic meridian. 2. The magnetic meridian of any place is supposed to depend upon the temperature of the place. 3. It is different at different places; and there is a line of no variation. Needles placed on this line point to the true north. 4. The variation is changing in the United States, at a rate varying from 2 to 7 minutes annually, in different localities. 5. You will find a concise statement in Gillespie's "Land Surveying."

© 1873 SCIENTIFIC AMERICAN, INC

F. G. W. says: On a railway in our neighborhood, much of the line has a grade of 160 feet to a mile; and in order not to exceed this grade, the line makes a long *detour* down the slope leading to a valley; the gage of the track is 3 feet; the rails are about 25 feet long, and weigh some twelve pounds a foot; they are put together in the usual way, with two iron straps and four bolts to each joint. A Baxter-Remington steam car has been running for a few days upon the finished portion of the line very successfully, making hourly and half hourly trips. With a pressure of steam of 125 pounds to the inch, it passes these heavy grades with forty passengers, without hesitation and with the speed of a brisk trot of a horse. When I first saw an illustrated description of the Baxter steam car in the SCIENTIFIC AMERICAN, I failed to comprehend how the exhaust steam from a small cylinder into a larger one could add any power to an engine without condensation, and my logic is still puzzled to make it out. But I suppose it is one of those things whose merits cannot be got at short of practical test. Here is a steam car with two cylinders, the pistons of which are five and eight inches diameter; these pistons are connected to the same crank shaft in the usual locomotive style; the small cylinder exhausts its steam into the large one and drives the eight inch piston with a force of perhaps 15 pounds to the square inch. Does not this 15 pounds react upon the five inch piston and detract from its effect nearly an equal amount? Is it possible that a partial vacuum is created in the larger cylinder or in the exhaust passage beyond by the momentum of the passing steam, after the manner of the Gifford injector? Answer: The pressure upon the large piston reacts upon the small one, as you suppose, creating back pressure; but as the area of the second piston is the greatest, the effective pressure, which equals total pressure minus back pressure, is available for purposes of locomotion.

R. F. asks: How are coiled springs, such as clock springs, tempered? Answer: First hardened in oil, then ground and polished, and afterwards hammered.

A. P. says: I have a small cylinder boiler made of five inch steam pipe 15 inches long, which I use for running a small engine. I have a cast iron plate that sits upon the stove with a hole large enough to permit one end of the boiler to go in the fire about 4 inches. The boiler sits upright upon the stove; there is no flue in the boiler. There is a head screwed in each end. The steam pipe is near the top. The trouble is that, when I raise steam and go to start the engine, the water rushes out ahead of the steam and it is some time before I can start the engine. I use but very little water, in order to get dry steam. Can you tell me of any way to prevent this? Answer: Perhaps by placing a dry pipe within the boiler, you may remedy the trouble.

T. H. N. asks: How shall I remove fleas from a valuable dog without injuring his hair? Answer: Use what is known as dog soap, which contains a large quantity of carbolic acid.

C. K. B. asks: 1. What is the rule for finding the horse power of tubular boilers, also the rule for the common two flue boiler? 2. Who is publisher of Auchincloss's "Link and Valve Motions?" Answers: 1. Only an approximate rule can be given. Divide the heating surface in square feet by 15. 2. The book is published by D. Van Nostrand.

A. R. says: 1. I have a small horizontal engine, 1½ inches bore x 3½ inches stroke: what is its power? It makes 150 revolutions per minute with 50 lbs. pressure. 2. What pressure would a boiler 8 inches diameter x 10 inches high, with flue in center two inches in diameter, made of 14 ounce copper, stand? Answers: 1. About ⅛ of a horse power. 2. Between 30 and 40 lbs. per square inch.

MINERALS.—Specimens have been received from the following correspondents, and examined with the results stated.

G. W. E.—This ore contains too much sulphur to be available as an iron ore.

C. P. H.—The stone enclosed is common quartz, of no value.

S. H.—The ore you send is iron pyrites. To determine the presence and amount of silver in it will cost $10.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Small, Fast Steamer. By J. G. X.
On Tidal Retardation. By E. F.
On Cumberland Gap Cave. By H. B. N.
On Solar Motion. By J. E. H.
On Retardation of the Earth. By J. T. H
On Gravitation. By S. J. W.
On Snake Bites. By J. H. H.
On Catching Rats, etc. By A. F.
On Boiler Explosions. By R. S. H.
On Water as Fuel. Ry H. O. L.
On Economical Steam Engines. By J.W. H
On Jumping from Railway Trains. By J. E. M.

Also enquiries from the following:

J. J. B.—D. M. S.—W. E.—T. A.—Z. Z. Z.—W. C. L.—E. K.—C. S.—W. G. D.—G. E. B.—A. T.—F. R. T.—J. B.—E. J. R.—S. Z. M.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

Correspondents in different parts of the country ask: Where steel bars, used in lieu of church bells, can be obtained? Where can a standard shape for teeth for gears be had? Where can a sewing machine, that makes stitches alike on both sides, be bought? Which is the best apple parer, corer and slicer? Where are head blocks for circular saw mills made? Which is the best machine for boring logs lengthwise, for tubing, etc.? Where can I get a carpenter's gage? Who makes machines for turning spindles for wagon backs? Where can I get a waterwheel tested? Who makes rubber balls and pins for ten pin alleys? Where are toy rubber balloons manufactured? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

August 5, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alloy, H. W. Wright 141,529
Alloy of nickel, etc., H. W. Wright 141,530
Animal poke, J. Hopkins 141,438
Axles, securing wheels to, Lessor & Shambo 141,570
Baby walker, J. Erikson 141,431
Bale band stretcher, F. M. Logue 141,447
Bale tie, cotton, W. Crone 141,494
Bark, machine for rossing, Martin & Wilson 141,448
Barrels, etc., painting, Burnet & Fisher 141,542
Bee hive, D. Latchaw 141,443
Belt gearing, idler for, Bell & Hillerick 141,417
Belting, making rubber, Gately & Forsyth 141,433
Billiard cue, H. Platts, (r) 5,522
Billiard table, G. Buntin 141,539
Blind slat operator, B. J. Williams, (r) 5,528
Blind stiles, machine for boring, A. B. Carlin 141,545
Boat detaching apparatus, S. Sneden 141,470
Boat, life, W. A. Vail 141,609
Bobbin, T. G. McLaughlin 141,575
Bobbins, machine for winding, J. Goodyear 141,434
Boiler attachment, wash, E. Davis 141,429
Boot and shoe, lasting, J. Brackett 141,420
Boot and shoe tree and stretcher, T. R. Evans 141,550
Box, match, A. Meyersberg 141,581
Box scraper, C., G. W. & J. D. Ellis 141,549
Box, spice, J. Sears 141,595
Brick machine, Irwin & Langdon 141,560
Bridge, iron, J. D. Pierce 141,458
Brush, paint, A. S. Thompson 141,522
Buckle, trace, J. Kennedy 141,565
Bung bushes, tool for seating, L. Littlejohn 141,511
Burner, gas, J. W. Averill 141,415
Bushing for faucet holes, S. R. Thompson 141,473
Buttons, making glass, H. Back, (r) 5,517
Cam, sectional slotted, F. D. Elderfield 141,548
Can, oil, F. C. Wilson 141,615
Canvas stretching frame, etc., A. Dickerman 141,547
Car brake, J. Temple 141,608
Car coupling, J. J. Fraikin 141,432
Car coupling, I. B. Lewis 141,445
Car starter for street railways, M. Toulmin 141,474
Carbonic acid apparatus, J. Matthews 141,571
Carpet stretcher, W. A. Boles 141,418
Carpet stretcher, J. Lindsay 141,446
Casks, barrels, etc., pitching, Meyer & Dick 141,449
Chair, folding, P. W. Nolan 141,456
Chair, folding, P. W. Nolan 141,457
Chimney cowl, J. Burgy 141,541
Chimney or globe holder, Wright & Race 141,478
Chucking tubes, etc., machine for, J. B. Root 141,593
Churn, E. Archer 141,480
Clothes wringer roller, E. P. H. Capron 141,424
Coal hod, J. H. Brown 141,485
Cock, stop, E. F. Spaulding 141,471
Copying press table, B. Brower 141,422
Corn sheller, E. L. Hutchinson 141,559
Cultivator, R. B. Robbins 141,462
Damper and ventilator, J. L. Skinner 141,601
Disinfecting powder, H. G. Dayton 141,546
Door check, L. Goodyear 141,435
Door check, J. A. McNabb 141,577
Drawer locking device, L. Renker 141,461
Elevator for passengers and freight, S. Nash 141,513
Engine, rotary steam, D. D. Hardy 141,436
Engines, frame for vertical, G. B. Sisson 141,467
Explosive compound, A. Nobel 141,455
Explosive compound, Norrbin & Ohlsson 141,585
Fence, G. Albro 141,532
Fence, portable, A. Mosher 141,584
Fence post, H. O. Elmer 141,493
Fire arm, breech-loading, Smith & Marshall 141,603
Fire arm, magazine, J. Rider 141,590
Fire extinguisher, D. J. Tapley 141,607
Flooring clamp, Wood & Terry 141,528
Fountain and pump, combined, J. J. Sink 141,600
Fruit, package for, D. Snedeker 141,605
Furnace, boiler, J. B. Root 141,594
Furnace, smoke burning, McGinniss & Naylor 141,574
Gage, carpenter's, J. A. Traut 141,475
Gage cock, H. J. Bailey 141,416
Gas condenser, P. T. Burtis 141,543
Gas, illuminating, W. Elmer 141,500
Gate, farm, E. B. Decker 141,497
Generator, steam, McNeill & Pratt 141,578
Generator, steam, J. B. Root, (r) 5,524
Glove fastening, Hall & Knott 141,555
Glove fastening, L. Meyers 141,580
Grain binder, A. S. Hoyt 141,507
Grain, separator for cleaning, G. B. Turner 141,524
Harvester, J. H. Shireman 141,597
Harvester, corn, A. Scott 141,466
Heater and purifier, Sadler & Volmar 141,517
Hemp brake, W. S. Lawrence 141,569
Hoisting apparatus, F. Farrel 141,551
Horseshoe, A. Leach 141,509
Hose sleeve, Bellemre & Fleer 141,536
Hub boring machine, E. Caswell 141,425
Ice shaving machine, J. D. Freeman 141,553
Insect powder gun, W. H. Ball 141,481
Insects, etc., destroying, J. B. Lunbeck 141,512
Knitting machine take up and tension, H. L. Arnold 141,534
Knob, silvered glass door, J. W. Haines 141,504
Latch, reversible knob, B. Erbe 141,430
Leather, manufacture of, Rawle & Evans 141,459
Lock, seal, T. Slaight 141,519
Loom picking stick check, R. Davis 141,496
Loom shedding mechanism, E. Redfearn 141,589
Mandrel, buffing, N. S. Thompson 141,523
Manganese, etc., making, O. Bolton, Jr 141,419
Matches, friction, C. F. Bonhack 141,483
Mill, cider, N. E. Miller 141,582
Mill, hominy, T. Hudnut, (r) 5,520
Millstone pick, T. R. Way 141,613
Mirror, window, Voss & Brandt 141,476
Mowing machine, W. V. Walker 141,611
Ore crushing stamp, G. D. Crocker 141,493
Organ coupler, R. E. Letton 141,444
Organ, reed, R. E. Letton 141,510
Organ, reed, J. A. Smith 141,468
Organ stop action, J. A. Smith 141,469
Oil, treating cotton seed, H. Goldman 141,503
Oyster dredge, Hornfager & Fitzgibbons 141,439
Paint compound, C. Campbell 141,544
Painters, filling for, R. Sharp 141,518
Paper, waterproof wall, C. Van Herwerden 141,525
Paper folding machine, Chambers & Mendham 141,489
Paper folding machine, Chambers & Mendham 141,490
Paper folding machine, packing, C. Chambers, Jr. 141,486
Paper folding machine, packing, C. Clark 141,491
Paper folding machine, packing, W. Parrington 141,501
Paper, etc., folding, C. Chambers, Jr 141,487
Paper, etc., folding and insetting, C. Chambers, Jr. 141,488
Pen and pencil case, C. H. Downes (r) 5,518
Pipe fittings, chuck for holding, M. Walty 141,612
Plane, metallic, J. A. Baines 141,525
Planting machine, Bright & Barrett 141,538
Plow, Andrews & Riviere 141,533
Plow, shovel, J. J. Mitchell 141,583
Printers' furniture, H. P. Montague 141,450
Propellers, elevating and depressing, S. G. Hill 141,558
Pump, Wolford & Conner 141,514
Pump for oil wells, J. B. Root (r) 5,525
Pump, steam vacuum, W. Burdon 141,540
Pump valve, W. Painter 141,586
Pump valve, A. J. Simmons 141,599
Purifier, middlings, A. Herr 141,557
Railway cattle guard, T. D. Kline 141,565
Railway rail, W. Peckham 141,515
Register, passenger, S. L. Cooper 141,492
Regulator, feed water, J. B. Root 141,592
Roofing, cemented slate, A. G. Hennion 141,457
Rope clamp, metallic, A. Méhu 141,579
Sand papering machine, D. & S. T. Armstrong 141,413
Sausages, stuffing, etc., J. A. Moore 141,451
Saw swage, McCollum & Emery 141,572
Saw teeth, removable, J. Crookes 141,427
Sawing machine, P. M. Andriot 141,479
Scaffold support, R. A. Edmonston 141,498
Scales, weighing, S. Harris 141,556
Screw cutting machine, H. O. Reed 141,460
Seed dropper, F. W. Young (r) 5,529
Seed sower, fertilizer, H. Springer 141,606
Seeding machine, H. C. Stephens 141,472
Sewing machine hemmer, A. McMillan 141,576
Sewing machine plaiter, W. Walker 141,613
Sewing machine tables, cover for, H. Jensen 141,561
Shaft bending machine, A. J. Fraser 141,552
Sheave, P. Kavanagh 141,564
Shed, brick yard, R. A. Smith 141,520
Shirt collar fastener, G. W. Brientnall 141,484
Show case, thread, A. Steward (r) 5,526
Spark arrester, M. Zeck 141,513
Spinning machine spindle, B. H. Jenks (r) 5,521
Spinning machine bolster, B. H. Jenks 141,440
Spinning machine bolster, B. H. Jenks 141,441
Spirituous liquors, treating and aging, G. Goewey 141,551
Sponge cup, W. McConnell 141,573
Starch, manufacture of, T. Kingsford 141,442
Steel ingots, J. A. Holmes 141,506
Steering apparatus for vessels, A. Siebenthal 141,598
Stove, cooking, W. W. Karshner 141,508
Stove grate, coal, S. G. Morrison 141,452
Stoves, magazine for, J. R. Painter 141,586
Straw cutter, T. Webb 141,547
Sugar cane coverer, F. Roy 141,464
Switch, self-operating, A. Bouchard 141,537
Table, folding, P. Munde 141,453
Telegraph, printing, T. A. Edison (r) 5,519
Telegraph, printing, Pope & Edison (r) 5,523
Telegraph, railway, J. G. Smith 141,604
Terret and martingale ring, J. Geraghty 141,502
Thrashing machine, J. Crowley 141,488
Thrashing machine, W. Verill 141,526
Tobacco, etc., cleaning, J. L. Jones 141,563
Tobacco, making plug, J. L. Jones 141,562
Toy, J. J. Arnaud 141,414
Toy money box, H. W. Prouty 141,516
Trap, fish, Pavonarius & Michtle 141,588
Trap, fly, A. J. Davis 141,495
Trap, sewer gas, G. C. Anthon 141,412
Trunk lid support, A. V. Romadka 141,591
Valve, check, J. H. Naylor 141,454
Valve register, J. W. Starr 141,521
Vehicle wheel, thimble skein for, J. Lahman 141,568
Vehicle running gear, L. R. Rosebrook 141,463
Veneer cutter, J. M. Seib 141,596
Vent gimlet, H. S. Rummer 141,465
Vessels, oscillating berth for, R. Weisker 141,614
Wagons, end gate for, Smillie & Brooks 141,602
Washing machine, J. H. Kooser 141,567
Water bowl, B. Brower 141,421
Water closet for vessels, W. Bishop 141,482
Water mains, stop gate for, D. C. Cregier 141,426
Water wheel, A. N. Wolf 141,616
Window fastener, Hawthorn & Scott 141,505
Window screen and shutter, B. J. Williams (r) 5,527
Wool on belts, cleaning, J. M. Brown 141,423
Wrench, S. W. Wakefield 141,477

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,028.—GAS.—L. D. Gale. October 22.
26,030.—GAS.—L. D. Gale. October 22.
26,087.—BALE HOOP FASTENING.—J. T. Butler. Oct. 29.
26,135.—PORTABLE PUMP.—W. T. Vase. October 29.
26,115.—WATER CLOSET COCK.—D. Wellington. Oct. 29.

EXTENSIONS GRANTED.

25,005.—GOVERNOR VALVE.—B. Fitts.
25,014.—WOODEN WARE CUTTER.—G. R. Hay.
25,036.—POSTMARKING STAMP.—M. P. Norton.
25,070.—ROOF FOR RAILWAY CARS.—A. P. Winslow,
25,235.—MANUFACTURE OF IRON.—B. Lauth.

DESIGNS PATENTED.

6,791.—COLLAR BOX.—R. W. Betts. New York city.
6,792.—NUBIA.—H. Boot, Philadelphia, Pa.
6,793 & 6,794.—BOAS.—G. H. Prindle, Philadelphia, Pa.
6,795.—SIGN.—H. B. Titus, Brooklyn, N. Y.
6,796 & 6,797.—CARPETS.—A. T. Webster, New Brunswick.

TRADE MARKS REGISTERED.

1,393.—WHISKY.—J. E. Cassidy, Boston, Mass.
1,394.—MEDICINE.—S. De Grath, Jersey City, N. J.
1,395.—GUANO.—B. M. Rhodes & Co., Baltimore, Md.
1,396.—FERTILIZERS.—O. Wittichen, Haymarket, Va.
1,397 to 1,399.—STEAM PACKING.—Silver Lake Co., Newtonville, Mass.
1,400 —BRAIDED CORDS.—Silver Lake Co., Newtonville, Mass.

SCHEDULE OF PATENT FEES:

On each Caveat $10
On each Trade-Mark $25
On filing each application for a Patent (17 years) ... $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On application for Extension of Patent $50
On granting the Extension $50
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On an application for Design (7 years) $15
On an application for Design (14 years) $30

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*.

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co. 37 Park Row New York

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust statue, alto relievo, or bas relief, any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons

© 1873 SCIENTIFIC AMERICAN, INC

who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1831 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawing and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors 37 Park Row, New York.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions, and advice, *no charge is made*. Write plain; do not use pencil or pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information and for pamphlets of instruction and advice

Address

MUNN & CO.,

PUBLISHERS SCIENTIFIC AMERICAN,

37 Park Row, New York.

OFFICE IN WASHINGTON—**Corner F and 7th Streets,** opposite Patent Office.

Advertisements.

RATES OF ADVERTISING.

Back Page - - - - - - - $1.00 a line.
Inside Page - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.

The value of the SCIENTIFIC AMERICAN *as an advertising medium cannot be over-estimated. Its circulation is ten times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading-rooms of the world. We invite the attention of those who wish to make their business known to the annexed rates. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $8.75 per line to advertise in one of forty-five thousand.*

MILLING MACHINES.
Universal and Plain—Gear and Cam Cutting, &c.
Send for illustrated catalogue to
BRAINARD MILLING MACH. CO.
115 Water St, Boston

INVENTORS, CAPITALISTS OR MANUFACTURERS
desiring to sell or purchase patent rights, or interests in unpatented inventions, or to form co-partnerships to manufacture, or arrange for introduction on royalty, or to purchase second hand steam engines at half price for cash (warranted) should address THE N. Y. EXPOSITION & M'F'G. CO., 52 Broadway, N. Y.

MACHINERY, NEW and 2d-HAND. Send for Circular. CHAS. PLACE & CO. 60 Vesey st., New York.

NEW YORK STEAM ENGINE CO.
MANUFACTURERS OF
Machinists Tools
OF ALL DESCRIPTIONS,
98 Chambers St. NEW YORK.

E. M. MAYO'S PATENT BOLT CUTTER. Send for Illustrated Circular, Cincinnati, Ohio.

WOODBURY'S PATENT
Planing and Matching
and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS, 91 Liberty street, N. Y.; 67 Sudbury street, Boston.
Send for Circulars.

PAGE'S Water Flame Coal Lime Kiln, with coal or wood. No. 1 Soft White Lime or Cement, with use of water. C.D. PAGE, Patentee. Rochester. N.Y.

TO INVENTORS AND MANUFACTURERS

The Managers of the 42d Exhibition of the American Institute, of the City of New York, beg to announce, that the Exhibition Buildings on 2d and 3d Avenues and 63d and 64th Streets, will be open for the reception of heavy Machinery August 18th and for other articles, September 1st 1873. The Exhibition will be formally opened September 10th.

For particulars, address "General Superintendent, American Institute, New York."

GLASS MOULDS for Fruit Jars, Patent Lamps, Bottles, etc., made by H. BROOKE. 14 years at White and Centre Streets, New York. The shortest and cheapest way order direct of Mould Maker.
☞ PARTICULAR ATTENTION paid to MOULDS for INVENTORS.

PATTERN & BRANDING LETTERS—SHARP, Flat or Rounding Surfaces—Large stock. PAVEMENT Letters, suitable for ARTIFICIAL STONE-WORK. VANDERBURGH, WELLS & CO., 18 Dutch, cor. Fulton St., New York

RIVERVIEW ACADEMY, Poughkeepsie N.Y.—Work recommences Sept. 11. Boys, "Fall in."

NUMEROUS TESTS HAVE PROVED N.F. BURNHAM'S NEW TURBINE **WATER WHEEL** TO BE THE BEST EVER INVENTED
PAMPHLET FREE. ADDRESS, YORK, PA

BUERK'S WATCHMAN'S TIME DETECTOR.—Important for al. large Corporations and Manufacturing concerns—capable of controlling with the utmost accuracy the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular. J. E. BUERK, P. O. Box 1,057 Boston, Mass.

N. B.—This detector is covered by two U. S. Patents, Parties using or selling these instruments without authority from me will be dealt with according to law.

WOODWORTH SURFACE PLANERS, $125. Planers and Matchers, $350. S. C. HILLS 51 Courtlandt street New York.

NEW & IMPROVED PATTERNS.—MACHINISTS' TOOLS—all sizes—at low prices. E. GOULD. 97 to 113 N. J R. R. Ave., Newark, N. J

WOOD-WORKING MACHINERY GENERALLY. Specialties, Woodworth Planers and Richardson's Patent Improved Tenon Machines. Central, corner Union st., Worcester, Mass. WITHERBY RUGG & RICHARDSON.

Claverack College and Hudson River Institute For both sexes; fine grounds; 167 furnished rooms; 20 instructors; 11 departments; 120 classical pupils; large gymnasium and drill hall. Special advantages in all departments. Term opens September 8. Rev. ALONZO FLACK, A. M., President, Claverack, N. Y.

$50 TO $150 PER WEEK guaranteed to intelligent and industrious persons, of either sex, to act as our Agents. Business very pleasant. Address THE WESTERN ART ASSOCIATION, Chicago, Ill.

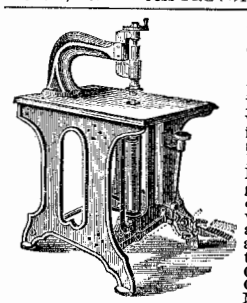
AGENTS—Most fortunate chance to make money, respectably and surely. $25 to $100 weekly, without fail. Article sells to every Lady and Gentleman. Address O. F. TEMPLETON, 615 Broadway, New York.

OTIS' SAFETY HOISTING **Machinery.**
OTIS, BROS. & CO.,
NO. 348 BROADWAY, NEW YORK.

$5 to $20 per day! Agents wanted! All classes of working people, of either sex, young or old, make more money at work for us in their spare moments or all the time than at anything else. Particulars free. Address G. Stinson & Co., Portland, Maine.

ROPER HOT AIR
ENGINE COMPANY. 70 New Church St. . New York

SHINGLE AND BARREL MACHINERY.—Improved Law's Patent Shingle and Heading Machine, simplest and best in use. Also, Shingle Heading and Stave Jointers, Stave Equalizers, Heading Planers, Turners, &c. Address TREVOR & Co. Lockport. N. Y.



BOULT'S PATENT Single Spindle Combined Moulding, Paneling, & Dovetailing Machine.
For Carving, Paneling, Irregular Moulding, and various size Dovetailing and Routing. The simplest and most useful Machine for Furniture, House-finishing, Cars, Organs, Drawers, Brackets, &c. Uses solid cutters, warranted to cut as free and smooth as flat knives and is no infringement on the Gear Combination Guide Head. B. C. M. Co., BATTLE CREEK, MICH.

SAVE 25 PER CENT OF FUEL—$66 Invested in Rogers' Tannate of Soda. BOILER SCALE PREVENTIVE. SAVED Oneida Community $750 year 1872. Recommended by the "Scientific American," "Iron Age," Engineers, and by hundreds who are using it. Will **Remove Old Scale** and entirely prevent the formation of new in all steam boilers. Warranted. Send for circular. WHITMAN & BURRELL, AGENTS, Little Falls, N. Y.

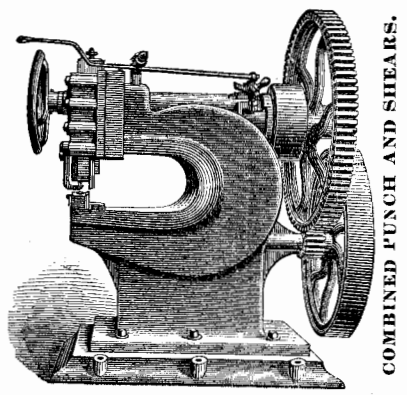
STEAM RECORDS!!!
The Recording Steam Gage Co., 91 Liberty street, make superior "Locomotive" and "Vacuum" Gauges, Engine Counters, and are Sole Makers under "Edson's Patents" of "Time and Pressure" Recording and "Alarm" Gauges. All work guaranteed.

12 Samples sent by mail for 50 cts., that retail quick for $10. R. L. WOLCOTT, 181 Chatham Square, New York.

Machinery,
Wood and Iron Working of every kind. Leather and Rubber Belting, Emery Wheels, Babbitt Metal, &c. GEO. PLACE & CO., 121 Chambers St, N.Y.

Cold Rolled Shafting.
Best and most perfect Shafting ever made, constantly on hand in large quantities, furnished in any lengths up to 24 ft. Also, Pat. Coupling and Self-oiling adjustable Hangers. GEORGE PLACE & CO., 121 Chambers Street, New York.

Sturtevant Blowers.
Of every size and description, constantly on hand. GEORGE PLACE & CO., 121 Chambers Street, New York.



SEND FOR PHOTOGRAPH AND PRICE.
MOSES G. WILDER,
121 CHAMBERS ST., N. Y.

COWELL PATENT DOOR AND GATE SPRING, worth ten of all others. Won't corrode or break. Ask the Hardware dealers for it, or address Sole Manufacturer, JAS. H. WHITE, Newark N. J. Territory for Sale.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price lists mailed on application to JONES & LAUGHLINS,
Try street, 2d and 3d aveaues, Pittsburgh, Pa.
190 S. Canal st., Chicago.
☞ Stocks of this Shafting in store and for sale by FULLER, DANA & FITZ. Boston, Mass.
GEO. PLACE & CO., 121 Chambers street. N. Y.
PIERCE & WHALING, Milwaukee, Wis.

STENCIL DIES For cutting business Stencils, all sizes. Also complete OUTFITS for Clothing Stencils and Key Checks, with which young men are making from $5 to $20 a day. Send for catalogue and samples to S.M. SPENCER, 117 Hanover St., Boston, Mass.

A POPULAR IDEA.
We have been furnishing the new, large illustrated paper, entitled "Cricket on the Hearth," at one dollar a year to subscribers on a guarantee that the money will be refunded any time within three months if not satisfactory. We have not been asked to return a dollar yet. 100,000 already sold. Sixteen large pages. The best and cheapest paper in the world. A $5 chromo to every subscriber. 25c. for three months on trial. Agents wanted. Send 25c. for the paper three months, and terms. JONES & HADLEY, Publishers, 176 Broadway, New York.

You ask WHY we can sell First Class 7 Octave Pianos for **$290?** We answer—It costs less than **$300** to make any **$600** Piano sold through Agents, all of whom make **100 per ct.** profit. We have no Agents, but ship direct to families at Factory price, and warrant 5 Years. Send for illustrated circular, in which we refer to over **500** Bankers, Merchants, &c. (some of whom you may know), using our Pianos, in **44** States and Territories. Please state where you saw this notice.
U. S. Piano Co., 810 Broadway, N. Y.

RICHARDSON, MERIAM & CO. Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash and molding, Tenoning, Mortising, Boring, Shaping, Vertical, and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty st, New York. 17

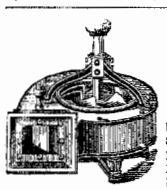
FOR SALE—The right to manufacture and Sell the Patent Stave Grain Baskets in the States of Ohio, Pennsylvania, and New York. Said Baskets protected by numerous patents issued to Horace C. Jones and others. G. I. BREWSTER, Appleton, Wis.

WROUGHT IRON BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided, we are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address Carnegie. Kloman & Co, Union Iron Mills, Pittsburgh, Pa.

MACHINERY FOR PRINTING OIL Cloth, Paper and Cotton. The Patent (No. 106,834) for Sale. Address J. KRAFT, 17 Gates Av., Brooklyn, N.Y.

$125 A MONTH to Lady Agents. Address ELLIS MANUFACTURING Co., Waltham, Mass,

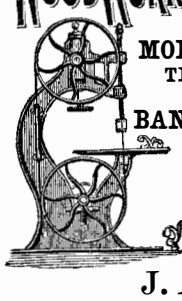


REYNOLDS'
Turbine Water Wheels.
30 years' experience enables me to excel in Gearing Mills of all kinds, and furnishing them **reliable,** economical power. Scientific pamphlet free. GEO. TALLCOT, 96 Liberty Street, New York.

THE HYDRAULIC ROTARY GOVERNOR secures to Water Wheels exact speed under all possible conditions, whether simple or the most complex. Under extreme variations it operates the entire gate in ten seconds. Warranty unlimited. No pay till tested.
JOHN S. ROGERS Treas., 19 John St Boston, Mass.

Andrew's Patents.
Noiseless, Friction Grooved, or Geared Hoisters, suited to every want.
Safety Store Elevators. Prevent Accident, Rope, Belt, and Engine break.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, 1-2 to 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical.
Send for Circulars.
WM. D. ANDREWS & BRO.,
414 Water Street, New York.

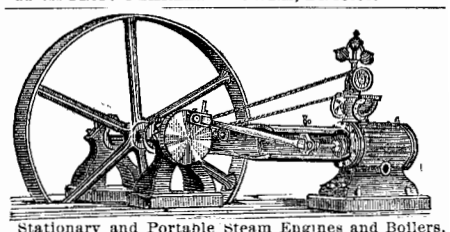
WOOD WORKING MACHINERY



MOLDING, MORTISING TENONING & SHAPING MACHINES; BAND SAWS, SCROLL SAWS, Planing & Matching MACHINES, &c.,
For RAILROAD, CAR, and AGRICULTURAL SHOPS, &c.,
☞ Superior to any in use.
J. A. FAY & CO.
CINCINNATI, Ohio.

1832. SCHENCK'S PATENT. 1871.
WOODWORTH PLANERS
And Re-Sawing Machines, Wood and Iron Working Machinery, Engines, Boilers, etc. JOHN B. SCHENCK'S SONS. Matteawan, N. Y. and 118 Liberty St., New York.

CIVIL AND MECHANICAL ENGINEERING AT **the Rensselaer Polytechnic Institute, Troy, N.Y.**—Instruction very practical. Advantages unsurpassed in this country. Graduates obtain excellent positions. Re-opens Sept. 17th. For the Annual Register, containing improved Course of Study, and full particulars address PROF. CHARLES DROWNE, Director.



Stationary and Portable Steam Engines and Boilers. Send for Circular. CLUTE BROTHERS & CO., Schenectady, N. Y.

TO FOUNDERIES, Factories, Ropewalks, &c.—For sale or lease, blocks of Lots, with bulkhead waterfront. Low prices, easy terms. S.B. SCHIEFFELIN, 15 East 26th Street, New York.

$72.00 EACH WEEK.
Agents wanted everywhere. Business strictly legitimate. Particulars free. Address, J. WORTH & Co., St. Louis, Mo.

IMPROVED FOOT LATHES, Slide Rests, Hand Planers for metal, Small Gear Cutters, Foot Scroll Saws. The very best. Selling everywhere. Catalogues free. N. H. BALDWIN, Laconia, N. H.

PORTABLE STEAM ENGINES, COMBINING the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than **1,000** being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address THE J. C. HOADLEY CO. Lawrence, Mass. Liberty st., New York.

An deutsche Erfinder.

Diese große und thätige Classe unsrer Bevölkerung machen wir besonders darauf aufmerksam, daß unsre Firma durch ihre Verbindung mit Washington und den europäischen Hauptstädten, besondere Vortheile zur Erlangung von in- und ausländischen Patenten bietet.

Jeder Erfinder, gleichviel welcher Nationalität angehörig, ist durch die liberalen Patentgesetze der Vereinigten Staaten zum Patentschutz für Erfindungen berechtigt. Unsre Firma ist bereit, gestützt auf 26jährige Erfahrung, deutsche Erfinder jeder Zeit zu berathen und zu mäßigen Preisen rasch und pünktlich Patente zu erlangen.

Die Deutsche Section ist in den Händen fähiger deutscher Ingenieure, welche in der Office persönlich mit Erfindern verkehren werden.

Der „Scientific American" wird in seinen Spalten die bedeutenderen Erfindungen besprechen.

Correspondenz erbeten und prompt beantwortet. Pamphlete in deutscher Sprache werden auf Verlangen franco zugesandt.

Adressire:

Munn & Co.,
„Scientific American" Patent Agentur,
37 Park Row,
New York City.

Niagara Steam Pump.
CHAS. B. HARDICK,
23 Adams st., Brooklyn, N. Y.

PUNCHING AND DROP PRESSES. For the **Best** and **Cheapest.** Address THE STILES & PARKER PRESS CO., MIDDLETOWN, CONN.

TRACKLAYING.
THE ROADMASTER'S ASSISTANT
AND SECTION MASTER'S GUIDE.
A manual of reference for all concerned in the construction or repair of the permanent way of American railroads, containing the best results of experience, and minute directions for tracklaying, ballasting and keeping the track in good repair.
Sent, post paid, for $1; twelve copies, $10.
Orders must be accompanied by the cash. Address the RAILROAD GAZETTE, 73 Broadway, N. Y.

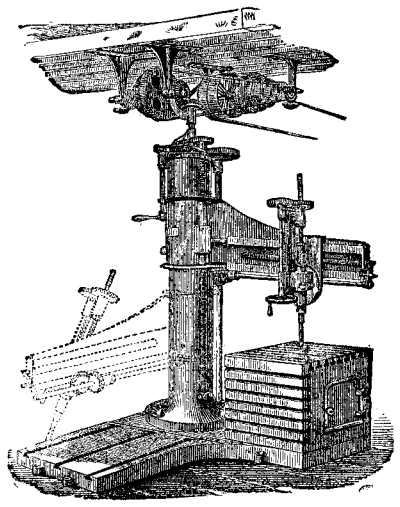
© 1873 SCIENTIFIC AMERICAN, INC

Advertisements

Advertisements will be admitted on this page at the rate of **$1.00** *per line for each insertion. Engravings may head advertisements at the same rate per line by measurement, as the letter-press.*

NILES TOOL WORKS,

HAMILTON, OHIO.



SILICATE OF SODA.

or Soluble Glass.

L. & J. W. FEUCHTWANGER, 55 Cedar St., N. Y.

PHOTO-ENGRAVING CO.

62 Courtlandt Street,

L. Smith Horary, Pres't. / John C. Moss, Sup't. / D. L. Carson, Gen'l Agt. — NEW YORK.

RELIEF PLATES

For Newspaper, Book and Catalogue Illustrations

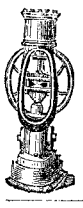
Engraved in very hard Type Metal, by a new chemical process, from all kinds of Pen-and-Ink Drawings, Original Designs, Photographs, etc. This process is in many respects vastly *superior to wood engraving.* The plates have a printing surface as smooth as glass, and the lines are deeper than those of hand-cut engravings. We guarantee all our plates to print *beautifully clean and sharp* on either wet or dry paper, and on any kind of press where type or wood cuts can be printed.

Illustrations for Manufacturers' Catalogues a Specialty.

Our Prices average about HALF the usual rates for wood cuts.

Illustrated Circulars Free. Book of Specimens $1.00.

The "Scientific American" uses our plates.



DOUBLE ACTING

BUCKET-PLUNGER

Steam Pumps

ALWAYS RELIABLE.

VALLEY MACHINE COMPANY,

Easthampton, Mass.

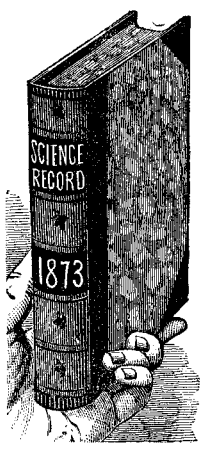
THE

SCIENCE RECORD

FOR

1873.

A Compendium of the Scientific Progress and Discoveries of the Preceding Year. Illustrated with over 150 Engravings. 600 pages, octavo. Price, $2.



THIS NEW AND splendid book embraces the most Interesting Facts and Discoveries in the various Arts and Sciences that have transpired during the preceding year exhibiting in one view the General Progress of the World in the following Departments:

1.—CHEMISTRY AND METALLURGY.
2.—MECHANICS AND ENGINEERING.
3.—ELECTRICITY, LIGHT, HEAT, SOUND.
4.—TECHNOLOGY.—Embracing New and Useful Inventions and Discoveries relating to THE ARTS:
5.—BOTANY AND HORTICULTURE.
6.—AGRICULTURE.
7.—RURAL AND HOUSEHOLD ECONOMY.
8.—MATERIA MEDICA, THERAPEUTICS, HYGIENE
9.—NATURAL HISTORY AND ZOOLOGY.
10 & 11.—METEOROLOGY, TERRESTRIAL PHYSICS, GEOGRAPHY.
12.—GEOLOGY AND MINERALOGY.
13.—ASTRONOMY
14.—BIOGRAPHY.

Every person who desires to be well informed concerning the Progress of the Arts and Sciences should have a copy of SCIENCE RECORD FOR 1873. It is a most interesting and valuable Book, and should have a place in every Household, in every Library.

600 pages, Octavo. Handsomely Bound. Over 150 Engravings. Price, $2.

Sent by mail to all parts of the country, on receipt of the price. A liberal discount to the trade and to canvassers. For sale at all the principal Bookstores.

MUNN & CO., PUBLISHERS,

37 Park Row, New York City.

THE *SCIENTIFIC AMERICAN* will be sent one year and one copy of *SCIENCE RECORD FOR* 1873, on receipt of $4·50.

SCIENCE RECORD FOR **1872,** uniform with the above. Price $2. Library binding, $2.50.

SILICATE OF SODA.

L. & J. W. FEUCHTWANGER, 55 Cedar St., N. Y.

PRINTED AT THE INDEPENDENT Press Rooms, 19, 21, and 23 Rose Street, N. Y., with 30 Cent Cut Ink, from G. H. MORRILL'S, 149 Washington street, Boston, Mass.

WHALEN TURBINE, No risks to purchaser. Pamphlet sent free. SETH WHALEN, Ballston Spa, N. Y.

Pass This By If you are a fool or a lunatic; but if you are sane, and wish to make money, (man or woman,) get a postal card NOW and send your address.

AGENTS MAKE $90 a Week. One Party Orders 1,000 TABLES.

EUREKA PORTABLE TABLE CO., ST. LOUIS, MO.

THE BEST OILS ARE THE CHEAPEST IN THE LONG RUN.

All who try E. H. KELLOGG's ENGINE and SPINDLE OILS Acknowledge the Fact.

They are really good substitutes for pure Sperm and Tallow Oils, are as free from gum or offensive odor, as handsome, and endure as cold temperature as best Winter Sperm Oil, while costing considerably less.

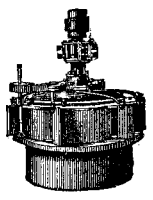
E. H. Kellogg's Extra Spindle Oil	$1.30	E. H. Kellogg's Extra Signal Oil	$1.25
E. H. Kellogg's No. 1 Spindle Oil	1.20	E. H. Kellogg's Signal Oil	1.00
E. H. Kellogg's Spindle Oil	1.00	E. H. Kellogg's Sperm Engine Oil	1.20
E. H. Kellogg's Extra Engine Oil	1.10	E. H. Kellogg's Sperm Spindle Oil	1.15
E. H. Kellogg's Engine Oil	1.00	E. H. Kellogg's Tallow Engine Oil	1.10
E. H. Kellogg's Extra Cylinder Oil	1.25	E. H. Kellogg's Tallow Spindle Oil	1.05

Manufactured only by E. H. KELLOGG, No. 17 Cedar Street, New York.

P. S. Should parties desire lower priced goods, we can furnish as low as the lowest and as good for the prices charged.—E. H. K.

PRICE REDUCED.

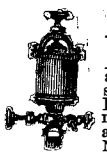
SAWS



THE AMERICAN

Turbine Water Wheel

Has recently been improved and subjected to thorough tests by James Emerson, Holyoke, Mass., showing higher average results than any Turbine Wheel ever known. A full report may be obtained of STOUT MILLS & TEMPLE, Dayton, Ohio.



LUBRICATORS.

DREYFUS' transparent Self-acting Oilers, for all sorts of Machinery and Shafting, are reliable in all seasons, saving 75—95 per cent. The **SELF-ACTING LUBRICATOR** for Cylinders is now adopted by over 150 R. R. in the U. S., and by hundreds of stationary engines. NATHAN & DREYFUS, 108 Liberty st., N. Y.

BEACH'S Scroll Sawing Machines.—Cheapest and best in use. For Illustrated Catalogue and Price List, send to H. L. BEACH, 90 Fulton St., N. Y.

Working Models

And Experimental Machinery, Metal, or Wood, made to order by J. F. WERNER, 62 Center st., N. Y.

PORTLAND CEMENT,

From the best London Manufacturers. For sale by JAMES BRAND, 55 Cliff St., N. Y.

A Practical Treatise on Cement furnished for 25 cents

IRON PLANERS, ENGINE LATHES Drills, and other Machinists' Tools, of superior quality, on hand, and finishing. For sale low. For Description and Price address NEW HAVEN MANUFACTURING CO. New Haven, Conn.

N. Y. PLASTER WORKS,

MANUFACTURERS of Calcined and Land Plaster, Marble Dust, Terra Alba, &c.,&c. Our DOUBLE EXTRA Plaster is *unsurpassed.* Every Barrel warranted. Our Quarries are in Nova Scotia. WORKS, 469, 471 & 473 CHERRY STREET, NEW YORK.

REYNOLDS & CO.

MANUFACTURE

Screws & Bolts

For Machinery of every variety.

ALSO

Bridge and Roof Bolts.

STEEL & IRON SET SCREWS

A specialty. Also, Small Articles for Patentees, in great numbers, at No. 145 East St., New Haven, Conn

Machinist's Tools,

EXTRA HEAVY AND IMPROVED.

LUCIUS W. POND, MANUFACTURER

Worcester, Mass.

Warerooms, 98 Liberty Street, New York.

A. C. STEBBINS, Agent.

AGENTS WANTED—Anybody can make it pay. First class articles for Office and House hold use. Manufacturer's prices, and enormous profits Address, for circular, JAS. H. WHITE, Newark, N. J.

WIRE ROPE.

JOHN A. ROEBLING'S SONS

MANUFACTURERS, TRENTON, N. J.

FOR Inclined Planes, Standing Ship Rigging Bridges, Ferries, Stays, or Guys on Derricks & Cranes, Tiller Ropes, Sash Cords of Copper and Iron, Lightning Conductors of Copper. Special attention given to hoisting rope of all kinds for Mines and Elevators Apply for circular, giving price and other information Send for pamphlet on Transmission of Power by Wire Ropes. A large stock constantly on hand at New York Warehouse No. 117 Liberty street.

SCHLENKER'S PATENT

BOLT CUTTER

NEW INVENTION. ADDRESS, HOWARD IRON WORKS, BUFFALO, N. Y.

THE STANDARD MAKE!

☞ Emery Wheels and Emery Grinding Machinery. **THE TANITE CO., Stroudsburg, Pa.**

B. F. STURTEVANT,

PATENTEE AND SOLE MANUFACTURER OF

PRESSURE BLOWERS & EXHAUST FANS

72 SUDBURY STREET BOSTON, MASS.

SEND FOR CATALOGUE, ILLUSTRATED WITH 40 ENGRAVINGS.

MORRIS, TASKER & CO.,

MANUFACTURERS OF

AMERICAN CHARCOAL IRON

Boiler Tubes.

WROUGHT-IRON TUBES AND FITTINGS, FOR GAS, STEAM WATER, AND OIL.

☞ Steam and Gas Fitters' Supplies, Machinery for Coal Gas Works, &c. &c.

NO. 15 GOLD ST., NEW YORK.

INDEPENDENT

BOILER FEEDERS

SEND FOR ILLUSTRATED CATALOGUE

COPE & MAXWELL MFG. CO.

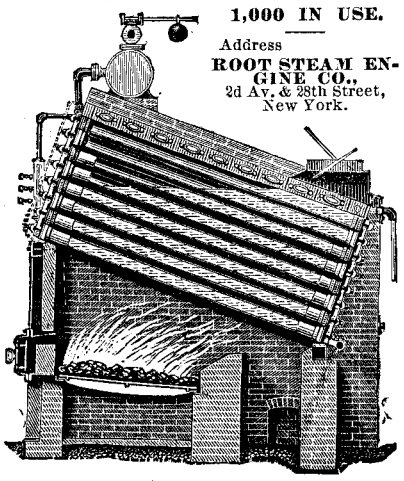
HAMILTON, OHIO.

1,000 IN USE.

Address

ROOT STEAM ENGINE CO.,

2d Av. & 28th Street, New York.



ROOT'S SAFETY BOILER.

NOYE'S MILL FURNISHING WORKS are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for catalogue.

J. T. NOYE & SON, Buffalo, N. Y.

RANSOM SYPHON CONDENSER perfects and maintains vacuum on Steam Engines at cost of one per cent its value, and by its use Vacuum Pans are run with full vacuum without Air Pump. Please call at the Company's office, Buffalo, N. Y. Circulars sent to any address.

BUILDING PAPER!

For Sheathing, Roofing, Deafening, Carpet Lining, and as a substitute for Plastering. Send for Samples and Circulars, to B. E. HALE & Co., 56 & 58 Park Place, N. Y., or ROCK RIVER PAPER CO., Chicago.

AMERICAN SAW CO.,

No. 1 Ferry St., New York.

Movable-Toothed Circular Saws

PERFORATED CROSS-CUT,

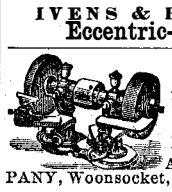
AND

SOLID SAWS.

ALSO,

IVENS & BROOKES PATENT

Eccentric-Geared Power Press.



EMERY WHEEL MACHINERY for grinding Tools and Metals, gumming Saws, cleaning Castings, grinding Planer Knives perfectly straight—unequaled for the sterling quality of its material and workmanship, the durability of every part. Address AMERICAN TWIST DRILL COMPANY, Woonsocket, R. I.

PATTERNS & TOOLS FOR SALE

The Burdon Iron Works (Hubbard & Whittaker) offer for sale their large stock of valuable patterns, including all kinds of Engines and Pumps; Pulley, Fly, Band, Gear and Worm Wheels; Sugar Mills, Friction Calender, Friction Clutch and Friction Wheels; Screw, Lever, Drop and Hydraulic Presses; Boiler Heads, Drum Heads, Boiler Fronts, Ash Pans, Grate Bars and Circular Grates; Pillow Blocks, Hangers and Boxes. Also a lot of Lathes, Drills, Planers, Shapers, and Boiler Makers' Tools.

HUBBARD & WHITTAKER,

Front & Pearl Sts., Brooklyn, N. Y.

The Pulsometer or Magic Pump.

The simplest, most durable and effective steam pump now in use. Adapted to all situations and performs all the functions of a steam pump without its consequent wear and care. No machinery about it. Nothing to wear out. Will pump gritty or muddy water without wear or injury to its parts. It cannot get out of order.

C. HENRY HALL & CO., 20 Cortlandt Street, New York City.

☞ T. V. Carpenter, Advertising Agent. Address Box 773, New York city.

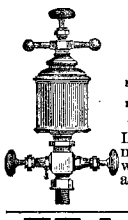
THREE PLY ROOFING,

In Use Ten Years.

A good article, well recommended, and suitable for either steep or flat roofs. Send for Circular and Samples. MICA ROOFING Co., 78 Maiden Lane, New York.

SILICATE OF SODA.

HODGES, COOLIDGE & CO., BOSTON, MASS.



THE

LATEST IMPROVEMENT

IN

LUBRICATORS

This NEEDLE-VALVE OIL FEEDER for Locomotive and Stationary Engines has met with great success. Master Mechanics will be furnished with Sample Cups by addressing

CINCINNATI BRASS WORKS.

MAHOGANY,

ROSEWOOD, WALNUT, WHITE HOLLY SATIN WOOD HUNGARIAN ASH, AND ALL KINDS OF WOODS, IN LOGS, PLANK, BOARDS, AND VENEERS.

GEO. W. READ & CO.,

Mill and Yard, 186 to 200 Lewis St., cor. 6th St., E. R., N. Y

☞ Orders by mail promptly and faithfully executed.

☞ Enclose 3c. stamp for Catalogue and Price List.

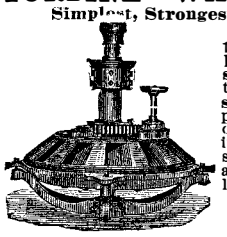
CHAMPION SPRING MATTRESS—The latest and best improvement. Do you want a healthy and comfortable bed? Here it is. The softest, easiest, cheapest, most popular, and durable Spring Bed in market. Sold by all leading dealers. No stock complete without it. Wholly composed of tenacious tempered steel springs, so united that the pressure is equally distributed. Easily moved or carried about the house. Can be lifted, turned, or rolled up like a blanket. Both sides alike. No frame, no wooden slats, no straps. May be used on floor without bedstead. No under bed required. Needs only half thickness of hair mattress. The regular size double bed, 4 ft. 6 in. by 6 ft., contains 192 steel upholstery springs and weighs only thirty lbs. More springs for your money in this bed than in any other. Warranted noiseless. Any sizes made to order Send for pictorial circular. Retail price of double bed, $13. Shipped, by single bed or quantity, to all parts of the world. Liberal discount to the trade. Agents wanted. F. C. BEACH & CO., Makers, 102 Chambers St., cor. Church New York.

BUILDERS SEND FOR BOOK CATALOGUE BICKNELL, 27 Warren st., N. Y

HOUSTON'S PATENT

TURBINE WATER WHEEL

Simplest, Strongest, Cheapest, Best.



In the test at Holyoke, in 1872, the Houston gave the **highest percentage ever showu** in a reliable test and the **highest average results ever obtained.** In practical use it is everywhere demonstrating its superiority over all others. Emerson's full report furnished on application. Send for Circular.

MERRILL & HOUSTON IRON WORKS, Beloit, Wisconsin.

P. BLAISDELL & CO.,

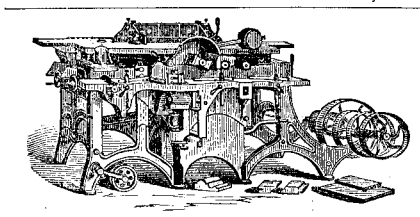
MANUFACTURERS OF THE BEST

Patent Drill Presses, with Quick Return Motion,

In the Market, also other Machinist Tools.

SEND FOR CUTS.

WORCESTER, MASS.



Universal Wood Worker, Horizontal and Upright Boring Machines

☞ Superior to any in use.

McBETH, BENTEL & MARGEDANT Hamilton, Ohio

SCIENTIFIC AMERICAN

TERMS.

One copy, one year	$3.00
One copy, six months	1.50
One copy, four months	1.00
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"	10.00
One copy of Scientific American for one year, and one copy of "Science Record," for 1873	4.50

Remit by postal order, draft or express.

The postage on the Scientific American is five cents per quarter, payable at the office where received. Canada subscribers must remit, with subscription, 25 cents extra to pay postage.

Address all letters and make all Post Office orders of drafts payable to

MUNN & CO.,

37 PARK ROW NEW YORK

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard sts., Philadelphia and 59 Gold st., New York.

© 1873 SCIENTIFIC AMERICAN, INC